MTE Corporation

Sine Wave Filter

Series A

200- 600 VAC

USER MANUAL

PART NO. INSTR - 020
REL. 080310

Sine Wave 2-8 kHz Series A Filter

IMPORTANT USER INFORMATION

NOTICE

The MTE Corporation Sine Wave Filter is designed to convert output voltage wave forms produced by a wide variety of PWM inverters into a low distortion sine wave for drive and power conversion applications. The suitability of this filter for a specific application must therefore be determined by the customer. In no event will MTE Corporation assume responsibility or liability for any direct or consequential damages resulting from the use or application of this filter. Nor will MTE Corporation assume patent liability with respect to the use of information, circuits or equipment described in this instruction manual.

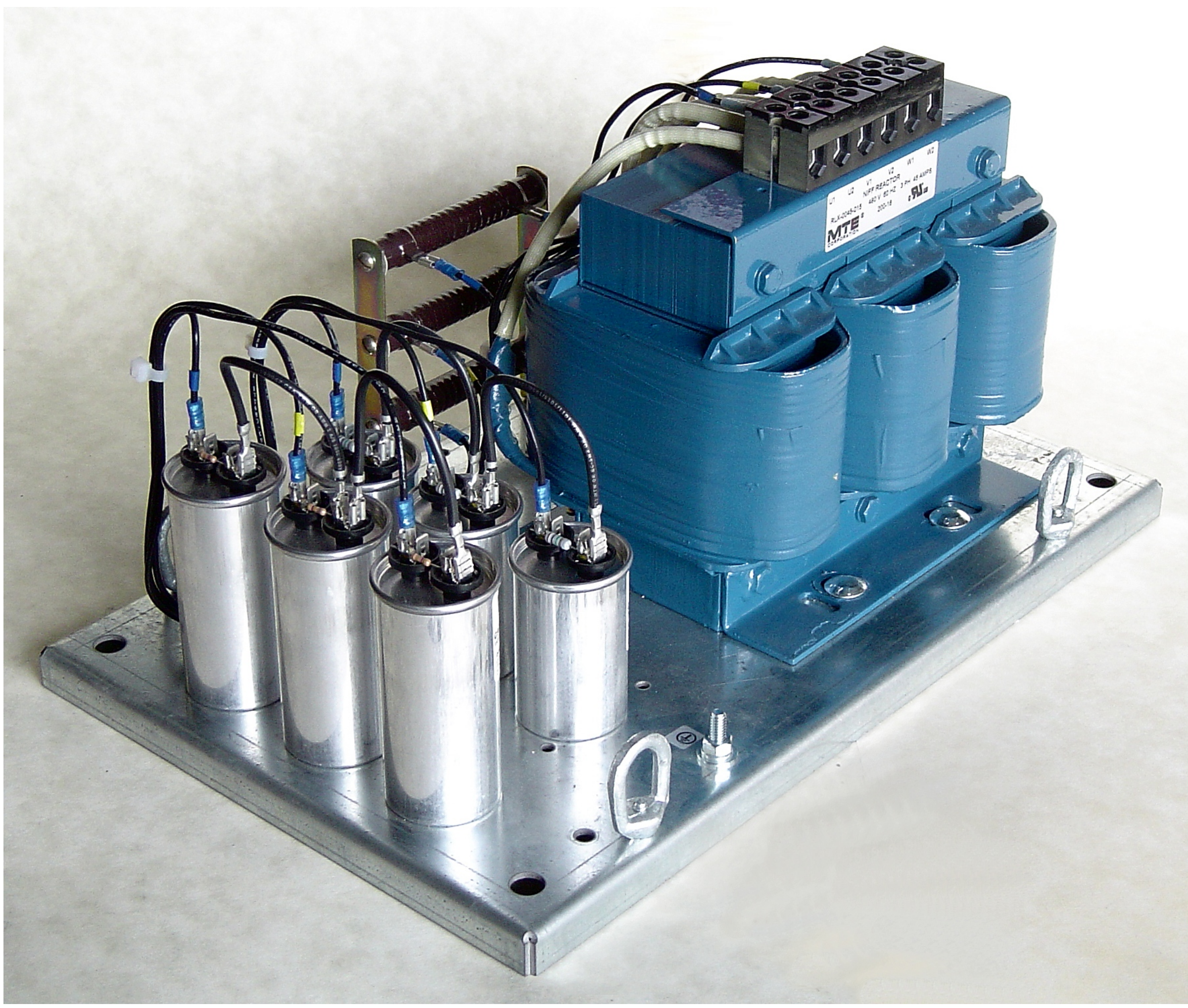


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Sine Wave 2-8 kHz Series A Filter

1. IMPORTANT SAFETY INFORMATION

WARNING

ONLY A QUALIFIED ELECTRICIAN CAN CARRY OUT THE ELECTRICAL INSTALLATION OF THIS FILTER

WARNING

High voltage is used in the operation of this filter. Use Extreme caution to avoid contact with high voltage when operating, installing or repairing this filter. **INJURY OR DEATH MAY RESULT IF SAFETY PRECAUTIONS ARE NOT OBSERVED.**

After removing power, allow at least five minutes to elapse and verify that the capacitors have discharged to a safe level before contacting internal components. Connect a DC voltmeter across the capacitor terminals. Start with the meter on the highest scale and progressively switch to a lower scale as the indicated voltage falls below the maximum value of the next lower scale used.

WARNING

The opening of the branch circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electrical shock, current-carrying parts and other components of the filter should be examined and replaced if damaged.

WARNING

An upstream disconnect/protection device must be used as required by the National Electrical Code (NEC).

WARNING

Even if the upstream disconnect/protection device is open, the inverter up stream of the filter may feed high voltage to the filter. The drive safety instructions must be followed. **INJURY OR DEATH MAY RESULT IF THE DRIVE SAFETY PRECAUTIONS ARE NOT OBSERVED.**

WARNING

The filter must be grounded with a grounding conductor connected to all grounding terminals.

WARNING

Only spare parts obtained from MTE Corporation or an authorized MTE distributor can be used.

2. INTRODUCTION

This manual was specifically developed to assist in the installation, interconnection and operation of the MTE Corporation Sine Wave filter.

This manual is intended for use by personnel experienced in the operation and maintenance of electronic drives. Because of the high voltages required by the filter and drive and the potential dangers presented by rotating machinery, it is essential that all personnel involved in the operation and maintenance of this filter know and practice the necessary safety precautions for this type of equipment. Personnel should read and understand the instructions contained in this manual before installing, operating or servicing the filter and inverter to which it is connected.

Upon Receipt of this Filter:

The MTE Sine Wave Filter has been subjected to demanding factory tests before shipment. Carefully inspect the shipping container for damage that may have occurred in transit. Then unpack the filter and carefully inspect for any signs of damage. Save the shipping container for future transport of the filter.

In the event of damage, please contact and file a claim with the freight carrier involved immediately.

If the equipment is not going to be put into service upon receipt, cover and store the filter in a clean, dry location. After storage, ensure that the equipment is dry and that no condensation has accumulated on the internal components of the filter before applying power.

Repair/Exchange Procedure

MTE Corporation requires a Returned Material Authorization Number before it can accept any filters that qualify for return or repair. If problems or questions arise during installation, setup, or operation of the filter, please call us for assistance at
:
Director of MTE corporate quality:
Phone: 262-253-8200 ex. 148

FAX: 262-253-8210

Sine Wave 2-8 kHz Series A Filter

3. MODEL NUMBER CODES

Model Code Part Number Configuration

SW A X Y _ _ _ _ X <u>YY</u>

Sine Wave filter

Series Version. A, X
"X" *denotes Non standard Configurations*

Mechanical Configuration P = Panel Mount
G = General Purpose
NEMA 1 or 2
W = NEMA 3R

Indicates Physical Size: A, B, C, D, etc. (A is smallest)

Current Rating (i.e. 0045 is 45 Amps)

Voltage
D 440 – 480
E 550 – 600

Options
01 NC Overtemp

Sine Wave 2-8 kHz Series A Filter

4. SPECIFICATIONS

Efficiency and Thermal Ratings

Table 1

Filter	200 - 230 VAC, 50/60 Hz Filter Ratings		380 - 480 VAC, 50/60 Hz Filter Ratings		550 - 600 VAC, 60 Hz Filter Ratings	
Maximum Output Amps RMS	Efficiency (Typical) (%)	Power Dissipation @ Rated Current (Typical) (Watts)	Efficiency (Typical) (%)	Power Dissipation @ Rated Current (Typical) (Watts)	Efficiency (Typical) (%)	Power Dissipation @ Rated Current (Typical) (Watts)
2	90.6	-	94.04	40	97.24	57
3	93.1	124	95.08	53	97.83	67
5	93.6	149	94.88	93	98.14	95
7	96.7	191	-	-	98.32	120
9	95.9	125	98.26	128	98.31	155
12	96.1	206	98.35	162	98.54	177
17	96.1	279	98.90	151	98.73	219
22	97.3	362	98.72	229	98.86	253
27	-	-	99.01	216	98.92	295
30	90.6	329	-	-	-	-
35	-	-	99.08	262	99.08	323
45	97.4	476	99.01	360	98.93	489
55	97.7	520	98.97	457	99.04	535
65	-	-	99.13	454	99.01	650
70	97.9	606	-	-	-	-
80	97.8	752	99.08	596	99.00	806
110	98.2	788	99.01	878	99.09	1014
130	98.2	989	99.20	836	99.12	1157
160	98.4	1062	99.23	996	99.02	1589
200	98.3	1377	99.20	1286	99.35	1315
250	98.4	1617	99.29	1424	99.34	1655
305	-	-	99.31	1701	99.27	2237
320	98.5	1991	-	-	-	-
365	-	-	99.37	1841	99.32	2489
415	-	-	99.40	2021	99.26	3098
515	-	-	99.29	2944	99.33	3229
600	-	-	99.24	3698	99.38	3406
720	-	-	99.33	4133	99.44	3935

Sine Wave 2-8 kHz Series A Filter

Service Conditions

Input voltage: 200 – 600 VAC +/- 10%, 50 & 60 Hz

Input voltage wave form: PWM

Switching Frequency: 2 – 8 kHz

Operating frequency: 6 – 60 Hz without de-rating

Temperature:	**Open filters**	**-40 to 50 °C**
	Enclosed filters	**-40 to 40 °C**
	Storage All types	**-40 to 90 °C**

Altitude without de-rating: 1000 meters

Relative Humidity: 0 to 99% Non condensing

Agency Approvals

UL and cUL listed to UL508 Type MX and CSA-C22.2 No 14-95
File E180243 (3 – 1000 HP, 120VAC through 600 VAC
50. 50/60, 60 Hz Three Phase

Note: Short Circuit rating not required under Exception No.1 of UL508A SB4.2.1 effective 4/25/06

Current Rating

Continuous current rating: 100% RMS

Intermittent current ratings: 150 % for 1 minute

Load : Conventional 3 phase motors operating in volts per Hertz mode
Standard step-up transformer with 4% minimum output impedance
"No load" continuous operation

Maximum motor lead length: 15,000 feet

Insertion loss: 10% of rated voltage maximum

Audible noise level at two meters for standard configuration: 76 DB-A

Performance

Harmonic voltage distortion feeding a transformer at full load and at 60Hz: 5% maximum

Harmonic voltage distortion feeding a motor at full load and at 60Hz: 5% typical

Sine Wave 2-8 kHz Series A Filter

Typical Performance Data

Fig.1

Raw drive output voltage

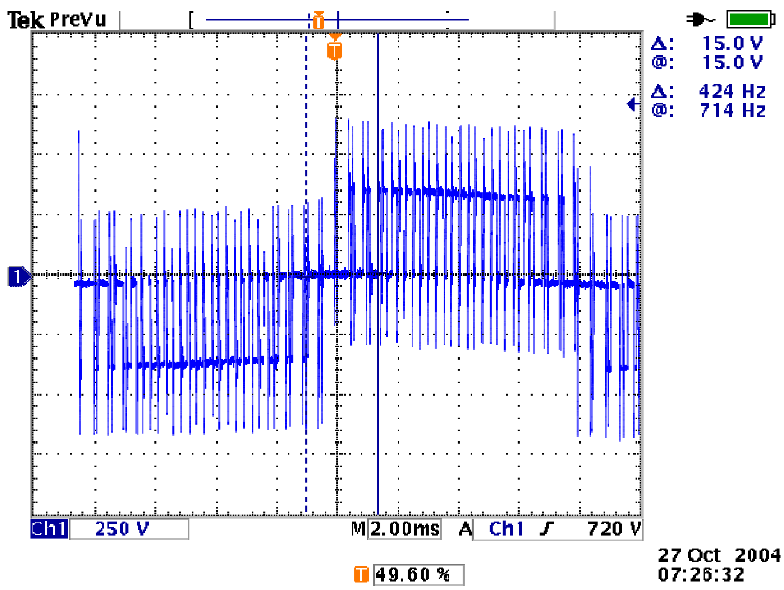
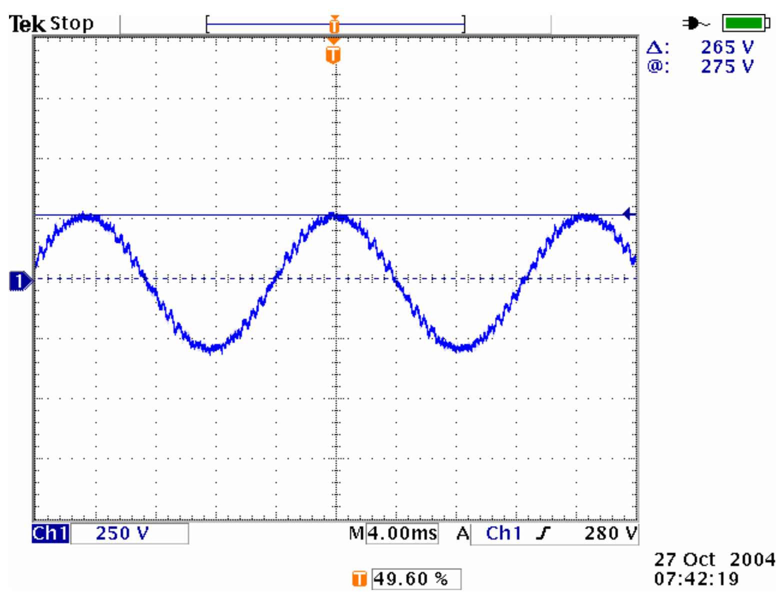


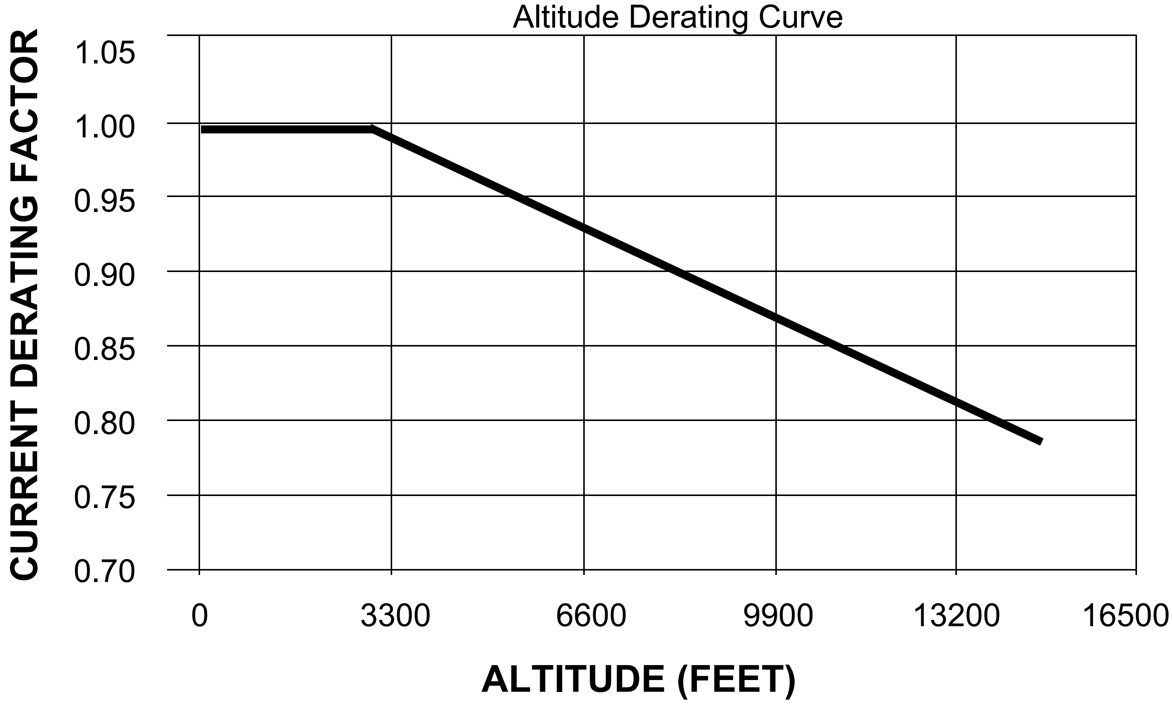
Fig. 2

Output voltage after sine wave filter

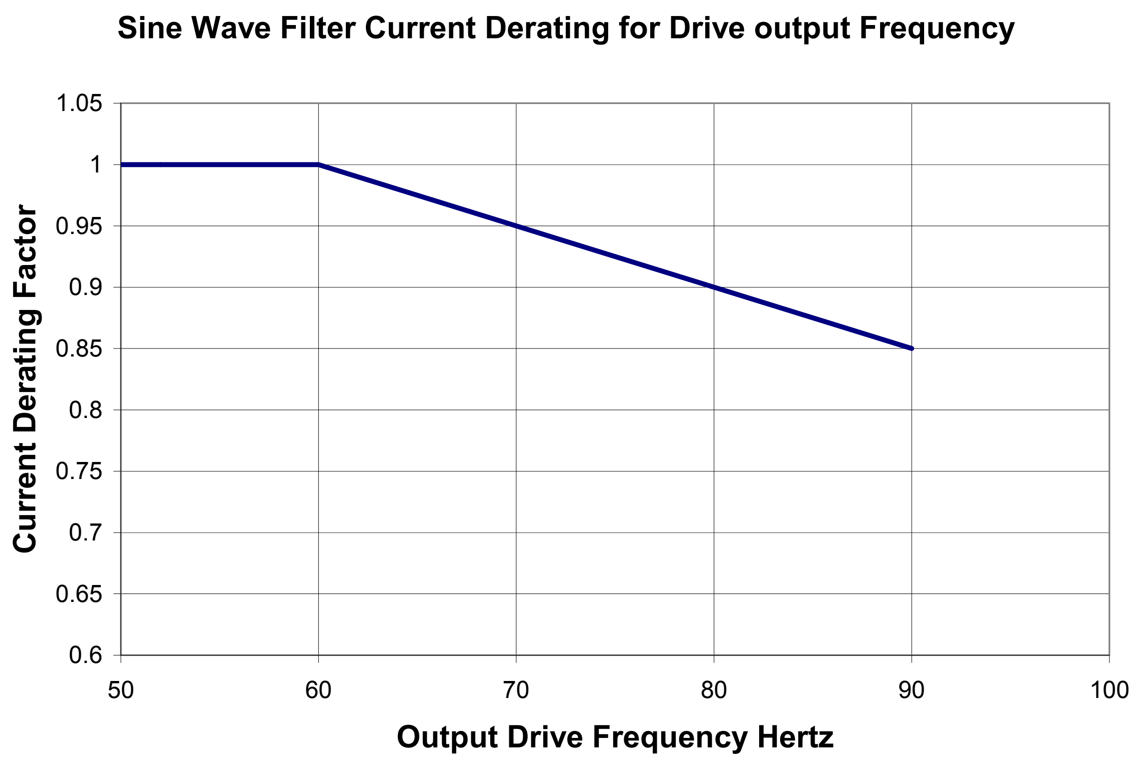


Sine Wave 2-8 kHz Series A Filter

Altitude De-rating
Chart 1



Inverter Frequency De-rating
Chart 2



5 Mechanical Data

200 - 230 Volts

Table 10

Filter Amps	Open			NEMA 1*			NEMA 3R		
	Cat PN.	WT Lbs	Fig.	Cat PN.	WT Lbs	Fig.	Cat PN.	WT Lbs	Fig.
3	**SWAP0003A**	16	3	**SWAGA0003A**	32	8	**SWAWA0003A**	89	10
5	**SWAP0005A**	21	3	**SWAGA0005A**	37	8	**SWAWA0005A**	94	10
7	**SWAP0007A**	24	3	**SWAGA0007A**	40	8	**SWAWA0007A**	97	10
9	**SWAP0009A**	24	3	**SWAGA0009A**	40	8	**SWAWA0009A**	97	10
12	**SWAP0012A**	27	3	**SWAGA0012A**	43	8	**SWAWA0012A**	100	10
17	**SWAP0017A**	31	3	**SWAGA0017A**	47	8	**SWAWA0017A**	104	10
22	**SWAP0022A**	32	3	**SWAGB0022A**	57	9	**SWAWB0022A**	133	11
30	**SWAP0030A**	38	4	**SWAGB0030A**	60	9	**SWAWB0030A**	136	11
45	**SWAP0045A**	47	4	**SWAGB0045A**	69	9	**SWAWB0045A**	145	11
55	**SWAP0055A**	55	4	**SWAGB0055A**	77	9	**SWAWB0055A**	153	11
70	**SWAP0070A**	60	4	**SWAGC0070A**	215	9	**SWAWC0070A**	249	11
85	**SWAP0085A**	73	A17 & B	**SWAGC0085A**	228	12	**SWAWC0085A**	262	12
110	**SWAP0110A**	92	A19 & B	**SWAGC0110A**	247	12	**SWAWC0110A**	281	12
135	**SWAP0135A**	100	A19 & B	**SWAGC0135A**	255	12	**SWAWC0135A**	289	12
160	**SWAP0160A**	121	A19 & B	**SWAGC0160A**	271	12	**SWAWC0160A**	305	12
200	**SWAP0200A**	167	A2 & C	**SWAGC0200A**	327	13	**SWAWC0200A**	351	13
250	**SWAP0250A**	196	A3 & C	**SWAGD0250A**	479	13	**SWAWD0250A**	531	13
320	**SWAP0320A**	228	A4 & C	**SWAGD0320A**	511	13	**SWAWD0320A**	563	13

Sine Wave 2-8 kHz Series A Filter

380 – 480 Volts

Table 2

Filter Amps	Open			NEMA 1			NEMA 3R		
	Cat PN.	WT Lbs	Fig.	Cat PN.	WT Lbs	Fig.	Cat PN.	WT Lbs	Fig.
2	**SWAP0002D**	16	3	**SWAGA0002D**	32	8	**SWAWA0002D**	89	10
3	**SWAP0003D**	18	3	**SWAGA0003D**	34	8	**SWAWA0003D**	91	10
5	**SWAP0005D**	22	3	**SWAGA0005D**	38	8	**SWAWA0005D**	95	10
9	**SWAP0009D**	27	3	**SWAGA0009D**	94	8	**SWAWA0009D**	100	10
12	**SWAP0012D**	27	3	**SWAGA0012D**	94	8	**SWAWA0012D**	100	10
17	**SWAP0017D**	30	3	**SWAGA0017D**	94	8	**SWAWA0017D**	100	10
22	**SWAP0022D**	37	4	**SWAGB0022D**	122	9	**SWAWB0022D**	135	11
27	**SWAP0027D**	38	4	**SWAGB0027D**	123	9	**SWAWB0027D**	136	11
35	**SWAP0035D**	51	4	**SWAGB0035D**	131	9	**SWAWB0035D**	144	11
45	**SWAP0045D**	57	4	**SWAGB0045D**	137	9	**SWAWB0045D**	150	11
55	**SWAP0055D**	67	4	**SWAGB0055D**	147	9	**SWAWB0055D**	160	11
65	**SWAP0065D**	77	5	**SWAGB0065D**	157	9	**SWAWB0065D**	170	11
80	**SWAP0080D**	86	5	**SWAGC0080D**	246	12	**SWAWC0080D**	270	12
110	**SWAP0110D**	117	A1& B	**SWAGC0110D**	277	12	**SWAWC0110D**	301	12
130	**SWAP0130D**	134	A2 & B	**SWAGC0130D**	294	12	**SWAWC0130D**	318	12
160	**SWAP0160D**	163	A3 & B	**SWAGC0160D**	323	12	**SWAWC0160D**	347	12
200	**SWAP0200D**	188	A4 & B	**SWAGD0200D**	471	13	**SWAWD0200D**	523	13
250	**SWAP0250D**	233	A6 & B	**SWAGD0250D**	516	13	**SWAWD0250D**	568	13
305	**SWAP0305D**	266	A7 & C	**SWAGD0305D**	549	13	**SWAWD0305D**	601	13
365	**SWAP0365D**	425	A8 & C	**SWAGD0365D**	631	13	**SWAWD0365D**	683	13
415	**SWAP0415D**	500	A10 & C	**SWAGD0415D**	700	13	**SWAWD0415D**	752	13
515	**SWAP0515D**	650	A12 & C	**SWAGD0515D**	814	13	**SWAWD0515D**	866	13
600	**SWAP0600D**	825	A13 & D	**SWAGE0600D**	1012	14	**SWAWE0600D**	1063	14
720	**SWAP0720D**	1125	A15 & D	**SWAGE0720D**	1128	14	**SWAWE0720D**	1179	14

Sine Wave 2-8 kHz Series A Filter

550 - 600 Volts

Table 3

Filter Amps	Open			NEMA 1			NEMA 3R		
	Cat PN.	WT Lbs	Fig.	Cat PN.	WT Lbs	Fig.	Cat PN.	WT Lbs	Fig.
2	**SWAP0002E**	18	3	**SWAGA0002E**	34	8	**SWAWA0002E**	91	10
3	**SWAP0003E**	21	3	**SWAGA0003E**	37	8	**SWAWA0003E**	94	10
5	**SWAP0005E**	24	3	**SWAGA0005E**	40	8	**SWAWA0005E**	97	10
7	**SWAP0007E**	26	3	**SWAGA0007E**	42	8	**SWAWA0007E**	99	10
9	**SWAP0009E**	27	3	**SWAGA0009E**	94	8	**SWAWA0009E**	100	10
12	**SWAP0012E**	27	3	**SWAGA0012E**	94	8	**SWAWA0012E**	100	10
17	**SWAP0017E**	37	4	**SWAGB0017E**	101	9	**SWAWB0017E**	107	11
22	**SWAP0022E**	38	4	**SWAGB0022E**	123	9	**SWAWB0022E**	136	11
27	**SWAP0027E**	45	4	**SWAGB0027E**	130	9	**SWAWB0027E**	143	11
35	**SWAP0035E**	58	4	**SWAGB0035E**	138	9	**SWAWB0035E**	151	11
45	**SWAP0045E**	63	4	**SWAGB0045E**	143	9	**SWAWB0045E**	156	11
55	**SWAP0055E**	75	5	**SWAGB0055E**	155	9	**SWAWB0055E**	168	11
65	**SWAP0065E**	86	5	**SWAGB0065E**	166	9	**SWAWB0065E**	179	11
80	**SWAP0080E**	117	A1 & B	**SWAGC0080E**	277	12	**SWAWC0080E**	301	12
110	**SWAP0110E**	146	A3 & B	**SWAGC0110E**	306	12	**SWAWC0110E**	330	12
130	**SWAP0130E**	166	A4 & B	**SWAGC0130E**	326	12	**SWAWC0130E**	350	12
160	**SWAP0160E**	194	A5 & B	**SWAGC0160E**	354	12	**SWAWC0160E**	378	12
200	**SWAP0200E**	236	A6 & B	**SWAGD0200E**	519	13	**SWAWD0200E**	571	13
250	**SWAP0250E**	280	A6 & B	**SWAGD0250E**	547	13	**SWAWD0250E**	599	13
305	**SWAP0305E**	425	A8 & C	**SWAGD0305E**	630	13	**SWAWD0305E**	682	13
365	**SWAP0365E**	490	A9 & C	**SWAGD0365E**	696	13	**SWAWD0365E**	748	13
415	**SWAP0415E**	726	A11 & D	**SWAGD0415E**	801	13	**SWAWD0415E**	853	13
515	**SWAP0515E**	750	A14 & C	**SWAGD0515E**	916	13	**SWAWD0515E**	968	13
600	**SWAP0600E**	1225	A15 & D	**SWAGE0600E**	1203	14	**SWAWE0600E**	1254	14
720	**SWAP0720E**	1375	A16 & D	**SWAGE0720E**	1327	14	**SWAWE0720E**	1378	14

6. INSTALLATION INSTRUCTIONS

Sine Wave filters are supplied in the following mechanical configurations:

Panel mounted assemblies

Floor mounted general purpose NEMA 1 & 3R cabinets

Panel mounted filters are designed for mounting in the vertical plane in the customer's enclosure. Include the power dissipation of the filter along with all the other components located in the panel to determine the internal temperature rise and cooling requirements of the enclosure. An option NC temperature switch may be added to protect against filter over heating. Allow a minimum side clearance of four (4) inches and a vertical clearance of six (6) inches for proper heat dissipation and access within the enclosure. Panel mounted Sine Wave filters generate heat and should be positioned away from heat sensitive components. Ensure that proper panel orientation is maintained. Keep the capacitors away from reactor and resistor heat flow. Avoid locations where the filter would be subjected to excessive vibrations.

Figures 3 – 5 contain open panel outline drawings for the various current ratings and show proper panel mounting orientation. For filters above 80 amps refer to table 4 and Figure A & B for the dimensions of the separately mounted reactor and the RC panel.

The RC panel should be located away from the reactor and in the lowest temperature regions of the enclosure – generally toward the bottom.

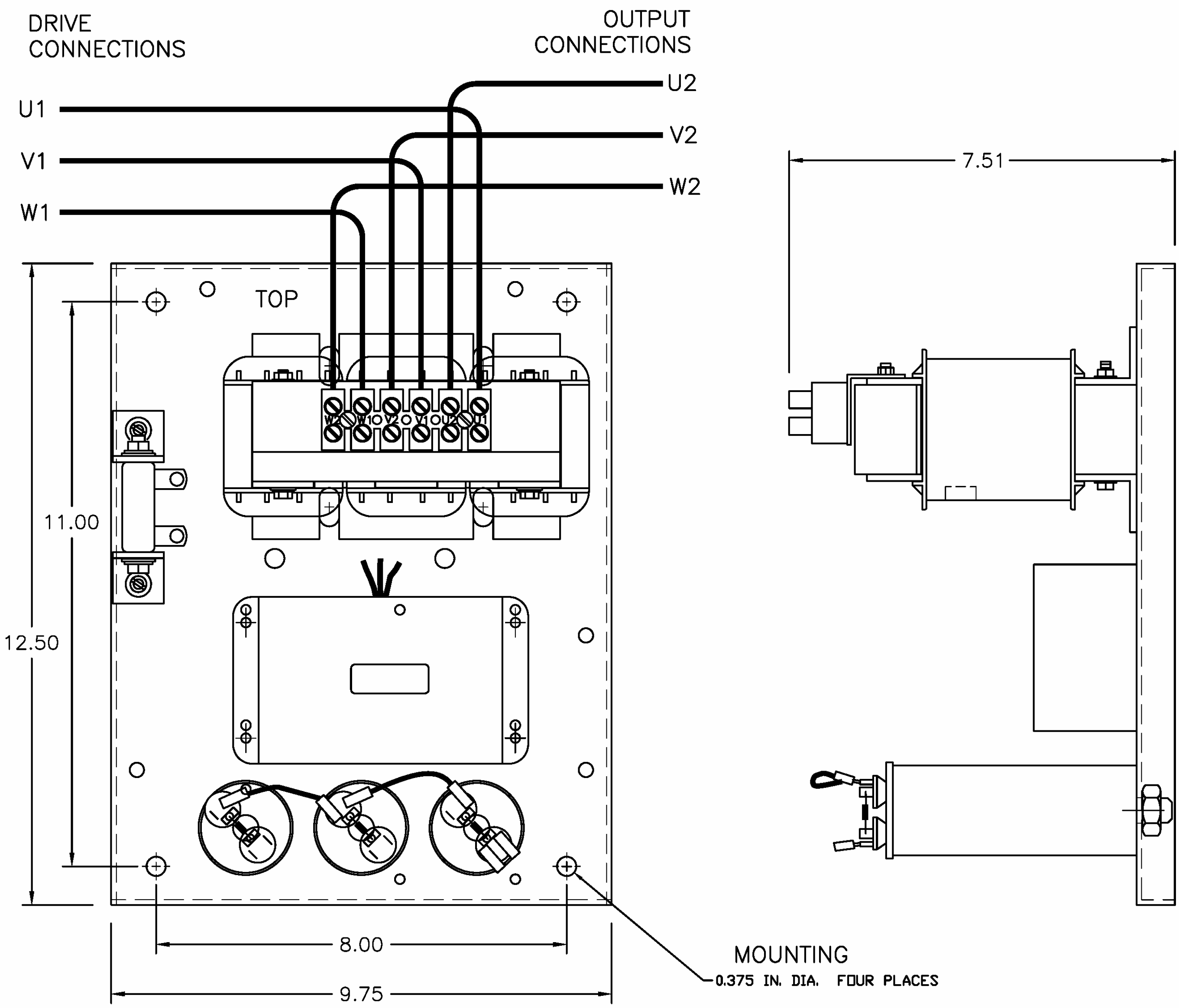
General purpose NEMA 1, 2 and 3R enclosed filters are designed for floor mounting in an environment suitable for the enclosure type. Do not install in or near a corrosive environment. Avoid locations where the filter would be subjected to excessive vibrations. Allow a minimum side and back clearance of eight (8) inches and front clearance of thirty-six (32 inches for proper heat dissipation and access. Page 20 will direct you to the appropriate outline drawings shown in fig. 8 through fig 14

Locate the filter as close to the inverter as possible. Do not exceed a maximum distance of 50 feet.

Sine Wave 2-8 kHz Series A Filter
Open Panel Customer connections

Open Panel:
3 – 30 Amps 200 - 230 VAC
9 - 17 AMPS 380 - 480 VAC
9 - 12 AMPS 550 - 600 VAC

Fig. 3

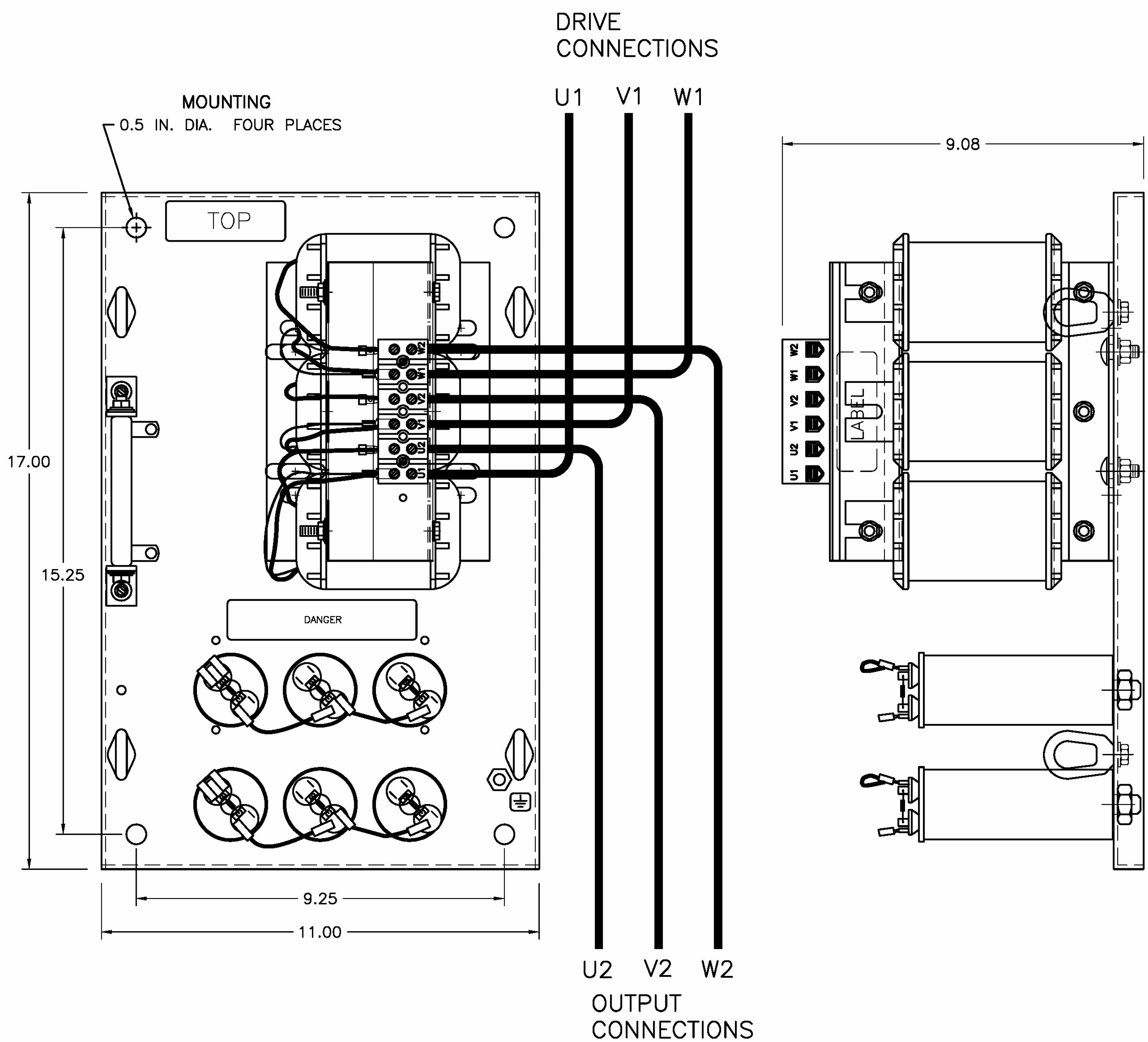


17 Amp Shown

Sine Wave 2-8 kHz Series A Filter

Open Panel:
45 – 60 AMPS 200 – 230 VAC
22 - 55 AMPS 440 - 480 VAC
17 - 45 AMPS 550 - 600 VAC

Fig. 4

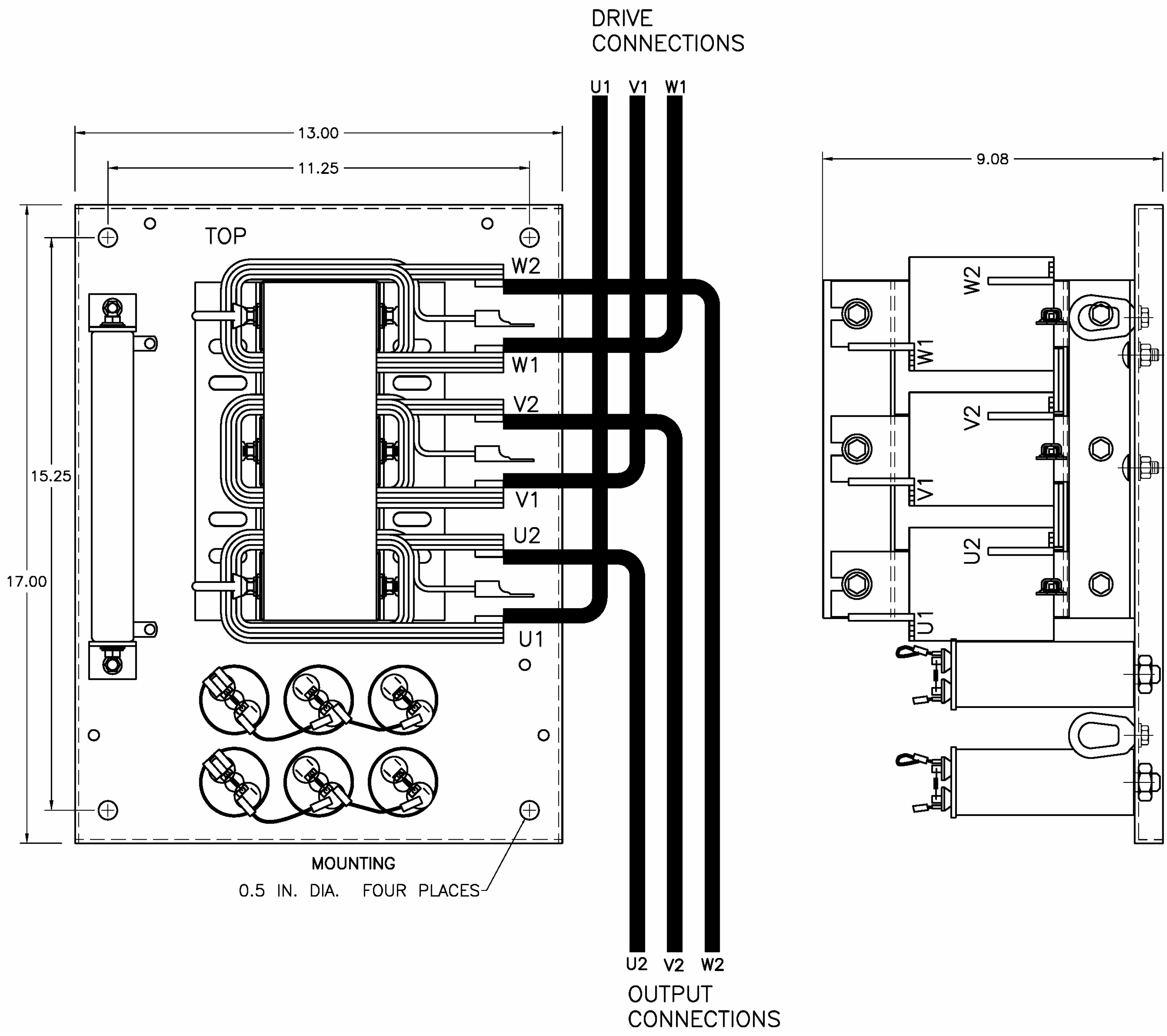


45 Amp shown

Sine Wave 2-8 kHz Series A Filter

Open Panel: 65 - 80 AMPS 440 - 480 VAC
55 - 65 AMPS 550 - 600 VAC

Fig. 5



80 Amp Shown

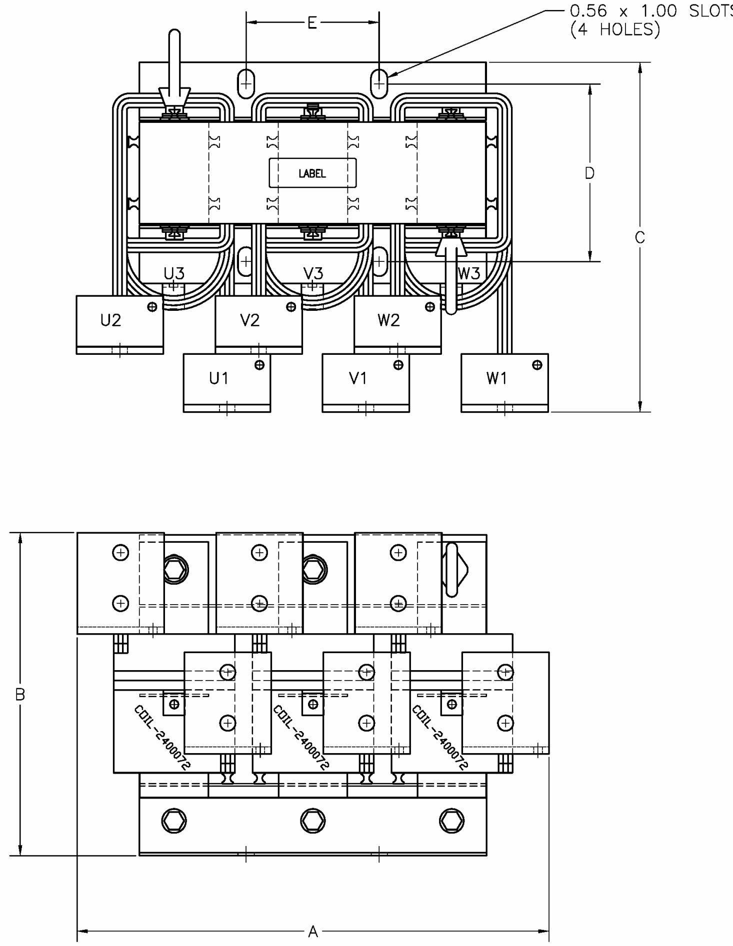
Sine Wave 2-8 kHz Series A Filter

Sine Wave Filters rated 80 amps through 720 amps are made up of a reactor and a RC panel. These components are designed to be mounted vertically within an appropriate enclosure. The reactor generates heat and should be mounted away from components affected by heat. Align the reactor to allow cooling air to flow through it. A filter showing correct reactor alignment and placement is shown in figure 6. The RC panel should be located in the lowest temperature regions of the enclosure – generally toward the bottom. An example of an MCC application is shown in Figure 7

Table 4

Figure	DIMENSIONS Inches				
	A (*W*)	B (*H*)	C (*D*)	D	E
A1	14.4	13	10.5	8.75	4.6
A2	14.4	13	10.75	8.75	4.6
A3	14.4	13	11.25	8.75	4.6
A4	14.4	13	11.5	9.25	4.6
A5	14.4	13	12.25	9.75	4.6
A6	14.4	13	13.5	10.75	4.6
A7	14.4	13	15	11.75	4.6
A8	22	17	12.5	6.7	7.2
A9	22	17	13.5	7.7	7.2
A10	22	17	15.5	8.2	7.2
A11	22	17	17	9.7	7.2
A12	22	17	15.5	9.7	7.2
A13	22	17	22	12.2	7.2
A14	22	17	17.75	11.2	7.2
A15	33.5	28.5	19.5	12.5	11
A16	33.5	28.5	20	12.5	11
A17	9	6.9	8.1	4.7	4.3
A18	14	13	11.8	6.7	7.2
A19	11	8.8	9.8	4.8	5.6

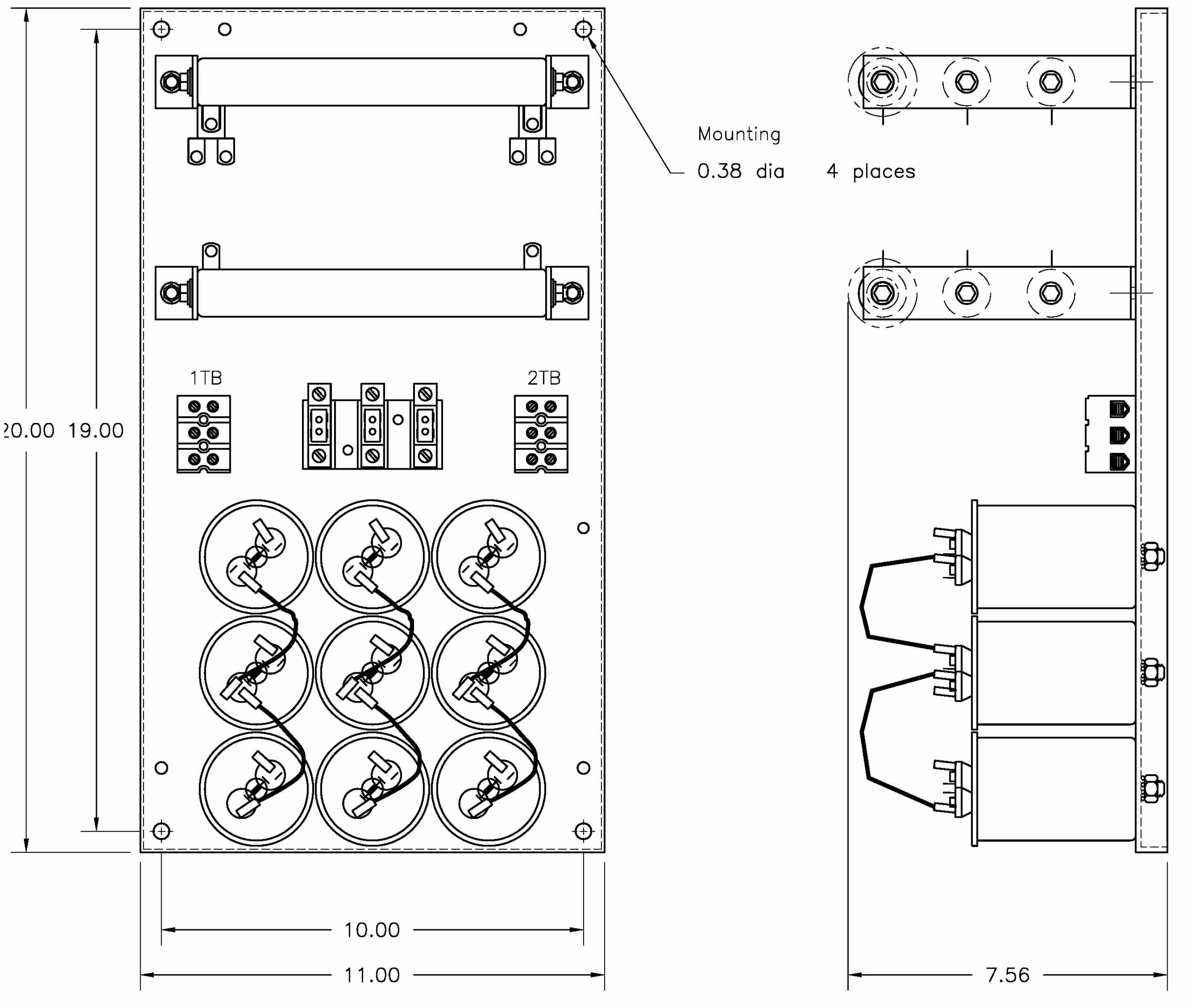
FIG. A



Sine Wave 2-8 kHz Series A Filter

RC Panel: 85 – 160 AMPS 200 - 230 VAC
110 - 160 AMPS 380 - 480 VAC
80 - 250 AMPS 550 - 600 VAC

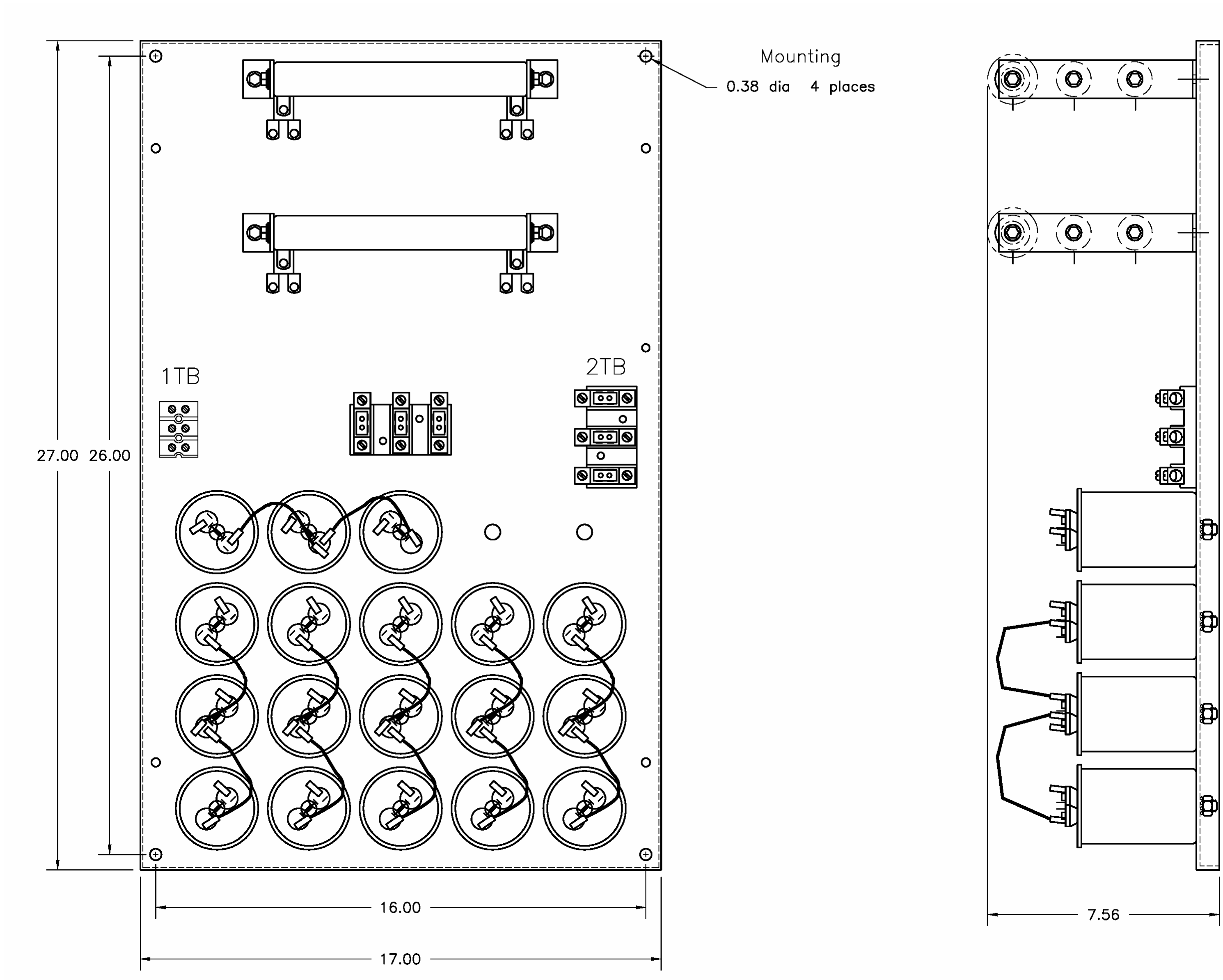
Fig. B



Sine Wave 2-8 kHz Series A Filter

RC Panel: 200 - 320 AMPS 200 - 230 VAC
200 - 515 AMPS 380 - 480 VAC
305, 365, 515 AMPS 550 - 600 VAC

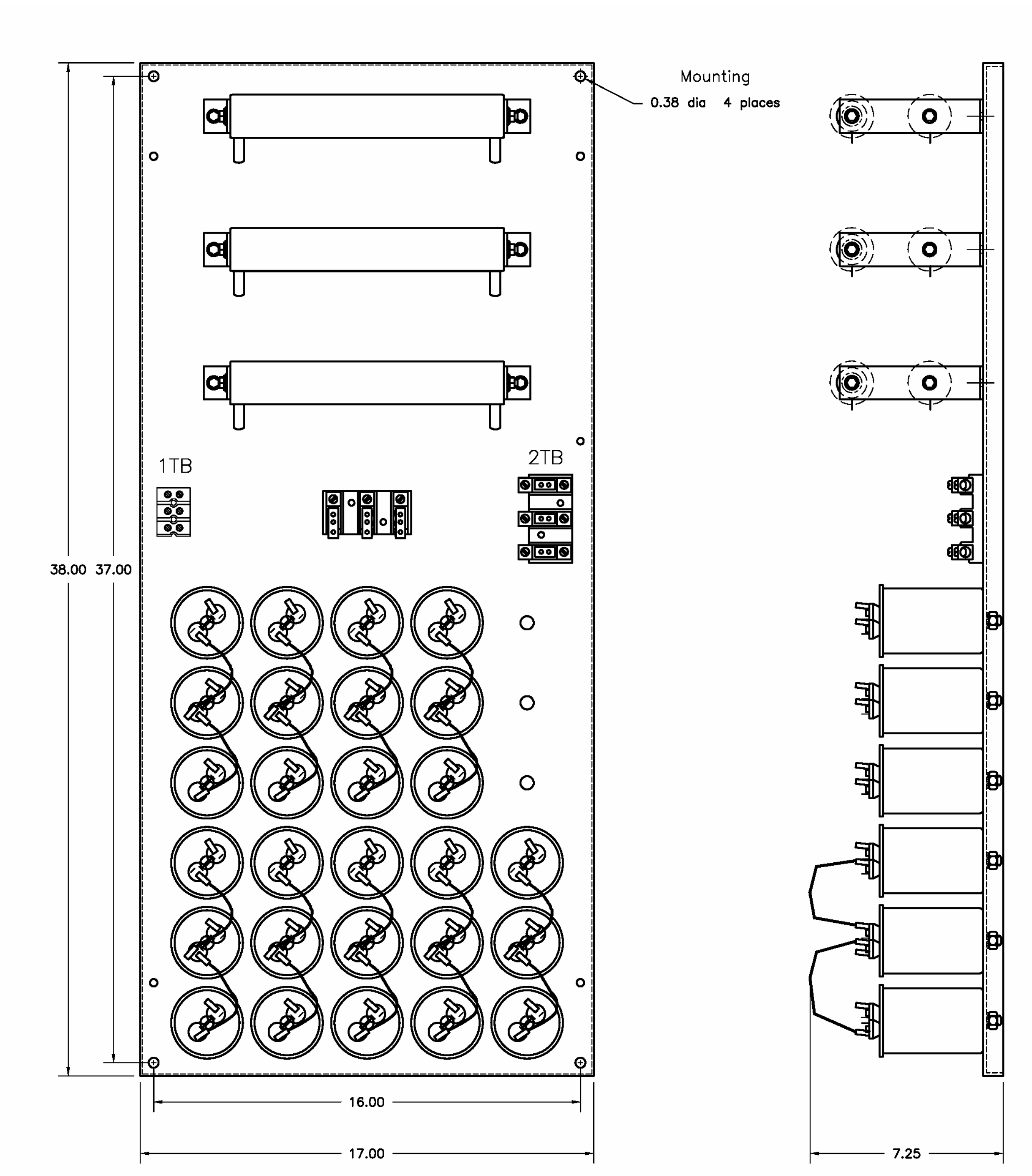
Fig. C



Sine Wave 2-8 kHz Series A Filter

RC Panel: 600 - 720 AMPS 440 - 480 VAC
415, 600, 720 AMPS 550 – 600 VAC

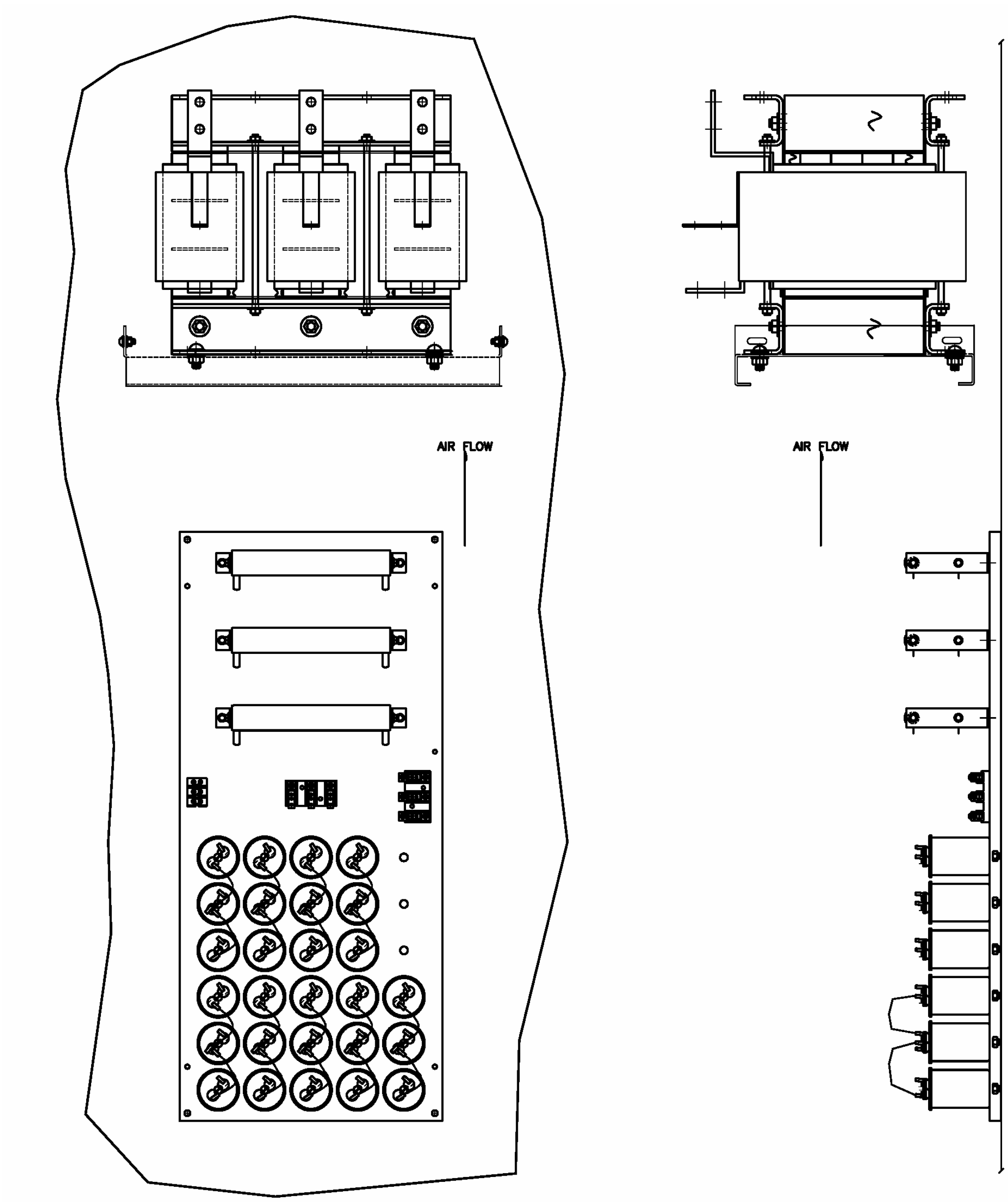
Fig. D



Sine Wave 2-8 kHz Series A Filter

Fig. 6

Vertical MOUNTING OF OPEN REACTOR & RC Panel



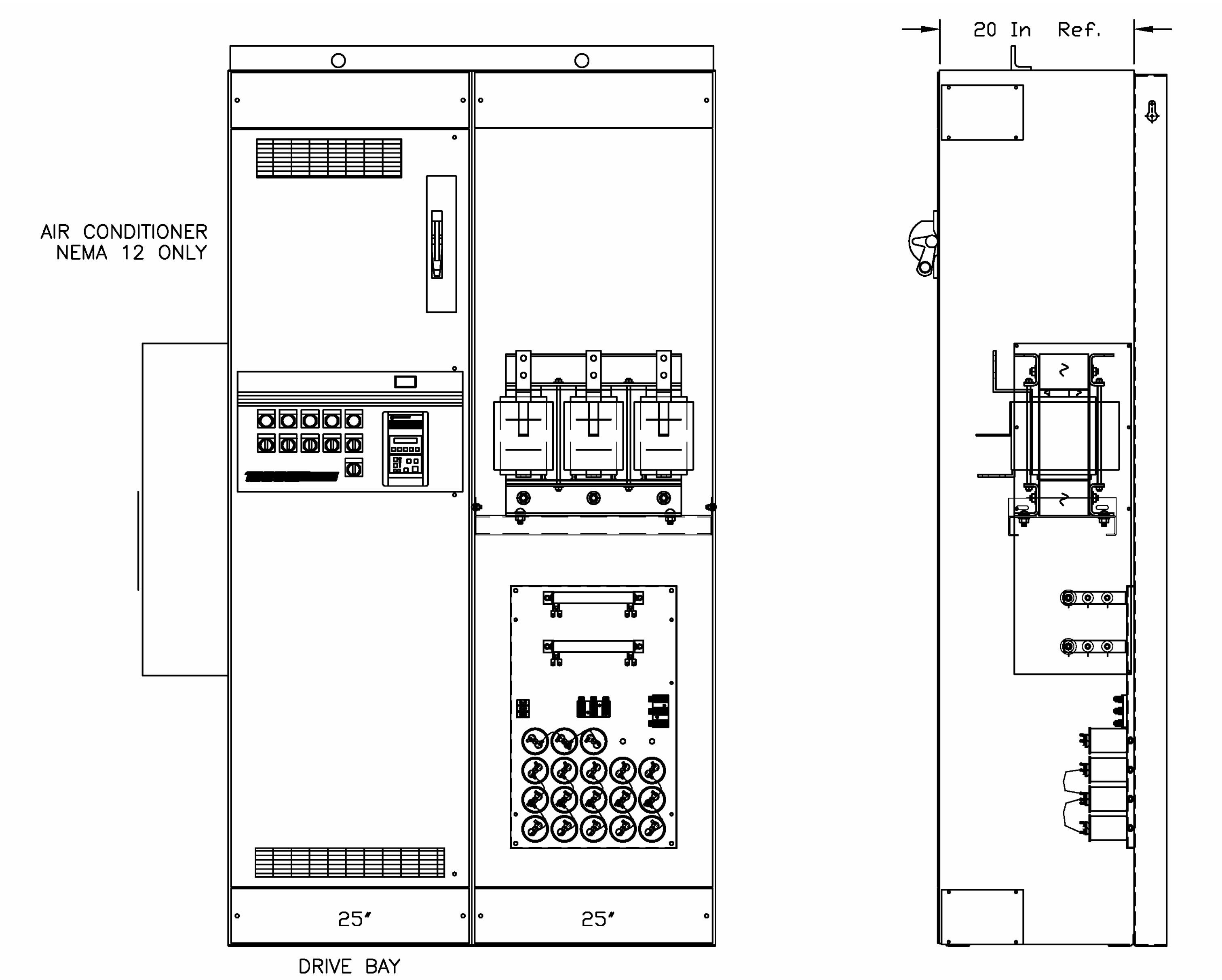
600 amp open reactor & RC panel shown in customer provided enclosure and mounting hardware.

NOTE: Maintain orientation as shown for proper component cooling. Do not place RC panel above reactor or position capacitors above resistors. RC panel may be mounted horizontally.

Sine Wave 2-8 kHz Series A Filter

350Hp MCC using optional bay for Sine Wave installation

Fig. 7



Note: The above Sine Wave filter example is shown with customer provided support hardware. Other installation variations are at the customer's discretion as long as thermal guidelines are followed.

Enclosed Units

Table 5

Enclosure Indicator	Width	Height	Depth	Cab Part No.	NEMA Type	Figure
GA	13	13	13	Cab 13V	NEMA 1	8
GB	17	24	18	Cab 17V	NEMA 1	9
GC	27	47	25	Cab 26C	NEMA 1 -2	12
GD	31	72	31	Cab 30C	NEMA 1 -2	13
GE	43	72	25	Cab 42C	NEMA 1 -2	14
WA	12.5	24	18	Cab 12C	NEMA 3R	10
WB	17.5	31	21	Cab 17C	NEMA 3R	11
WC	26.5	47	30	Cab 26C	NEMA 3R	12
WD	30.5	72	40	Cab 30C	NEMA 3R	13
WE	43	72	34	Cab 42C	NEMA 3R	14

See Mechanical Data for enclosed weights.

Sine Wave 2-8 kHz Series A Filter

Enclosed Units By Current

Table 6

Filter Current Rating	General Purpose Cabinets 200– 230 VAC		General Purpose Cabinets 380 – 480 VAC		General Purpose Cabinets 550– 600VAC	
	NEMA 1	NEMA 3R	NEMA 1	NEMA 3R	NEMA 1	NEMA 3R
2	CAB-13V	CAB-12C	CAB-13V	CAB-12C	CAB-13V	CAB-12C
3	CAB-13V	CAB-12C	CAB-13V	CAB-12C	CAB-13V	CAB-12C
5	CAB-13V	CAB-12C	CAB-13V	CAB-12C	CAB-13V	CAB-12C
7	CAB-13V	CAB-12C	CAB-13V	CAB-12C	CAB-13V	CAB-12C
9	CAB-13V	CAB-12C	CAB-13V	CAB-12C	CAB-13V	CAB-12C
12	CAB-13V	CAB-12C	CAB-13V	CAB-12C	CAB-13V	CAB-12C
17	CAB-13V	CAB-12C	CAB-13V	CAB-12C	CAB-17V	CAB-17C
22	CAB-17V	CAB-17C	CAB-17V	CAB-17C	CAB-17V	CAB-17C
27	-	-	CAB-17V	CAB-17C	CAB-17V	CAB-17C
30	CAB-17V	CAB-17C	-	-	-	-
35	CAB-17V	CAB-17C	CAB-17V	CAB-17C	CAB-17V	CAB-17C
45	CAB-17V	CAB-17C	CAB-17V	CAB-17C	CAB-17V	CAB-17C
55	CAB-17V	CAB-17C	CAB-17V	CAB-17C	CAB-26C	CAB-26C
65	-	-	CAB-17V	CAB-17C	CAB-26C	CAB-26C
70	CAB-17V	CAB-17C	-	-	-	-
80	-	-	CAB-26C	CAB-26C	CAB-26C	CAB-26C
85	CAB-26C	CAB-26C	-	-	-	-
110	CAB-26C	CAB-26C	CAB-26C	CAB-26C	CAB-26C	CAB-26C
130	-	-	CAB-26C	CAB-26C	CAB-30C	CAB-30C
135	CAB-26C	CAB-26C	-	-	-	-
160	CAB-26C	CAB-26C	CAB-26C	CAB-26C	CAB-30C	CAB-30C
200	CAB-30C	CAB-30C	CAB-30C	CAB-30C	CAB-30C	CAB-30C
250	CAB-30C	CAB-30C	CAB-30C	CAB-30C	CAB-30C	CAB-30C
305	-	-	CAB-30C	CAB-30C	CAB-30C	CAB-30C
320	CAB-30C	CAB-30C	-	-	-	-
365	-	-	CAB-30C	CAB-30C	CAB-30C	CAB-30C
415	-	-	CAB-30C	CAB-30C	CAB-42C	CAB-42C
515	-	-	CAB-30C	CAB-30C	CAB-42C	CAB-42C
600	-	-	CAB-42C	CAB-42C	CAB-42C	CAB-42C
720	-	-	CAB-42C	CAB-42C	CAB-42C	CAB-42C

Mounting dimensions and outline drawings for filters mounted in NEMA 1, 3R Enclosures follow

Sine Wave 2-8 kHz Series A Filter

Enclosed NEMA 1

Fig. 8 Cab - 13V

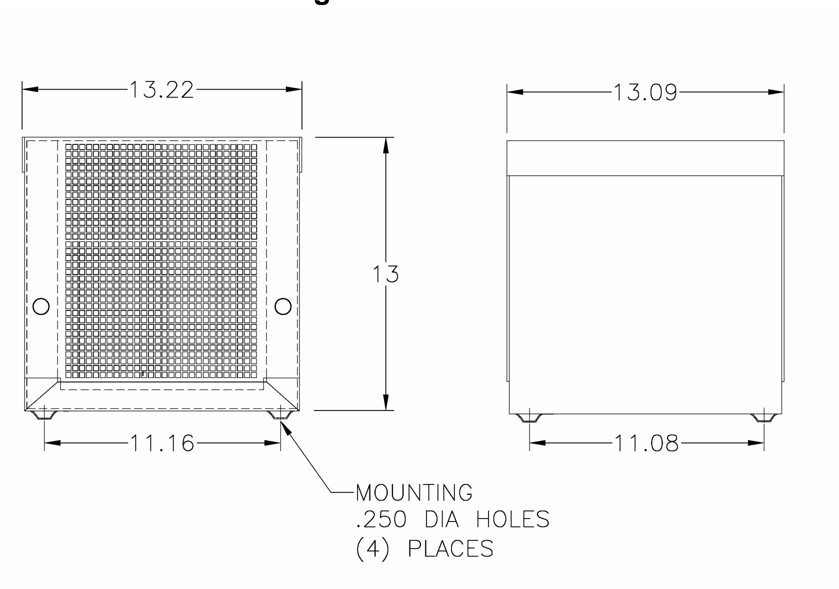
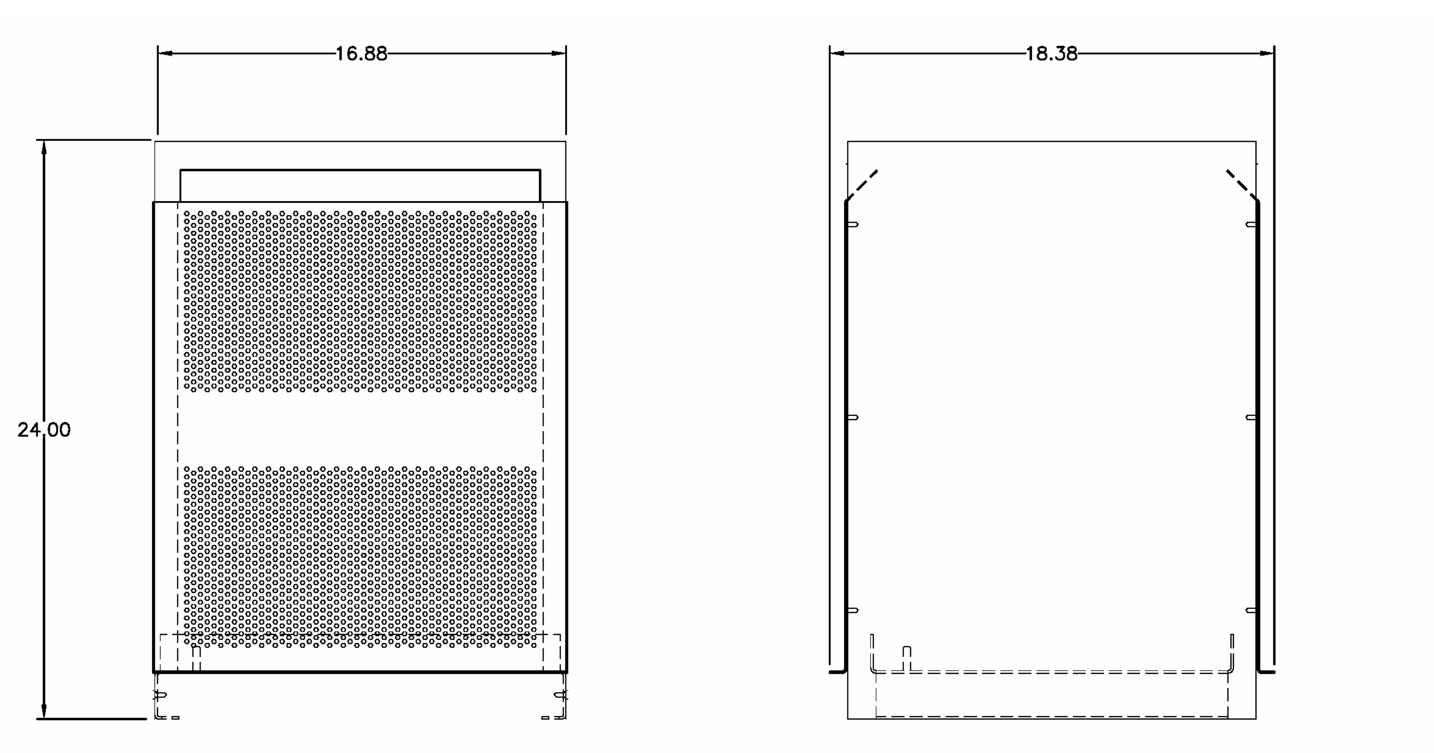


Fig. 9 Cab - 17V



Sine Wave 2-8 kHz Series A Filter
Enclosed NEMA 1-2 & 3R units

Fig. 10 Cab - 12C

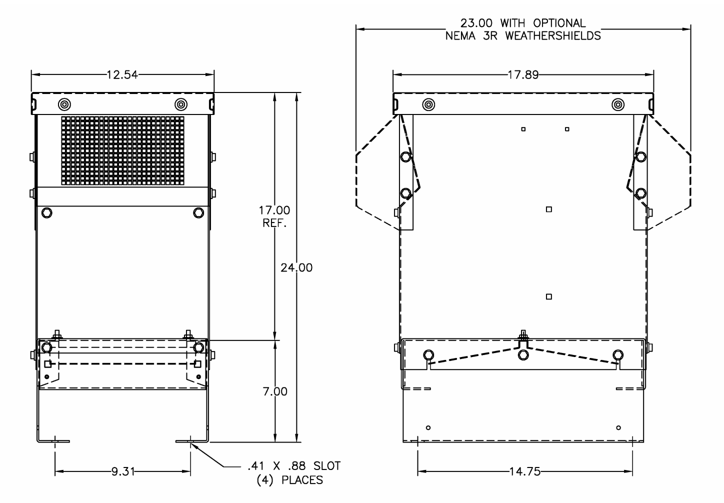
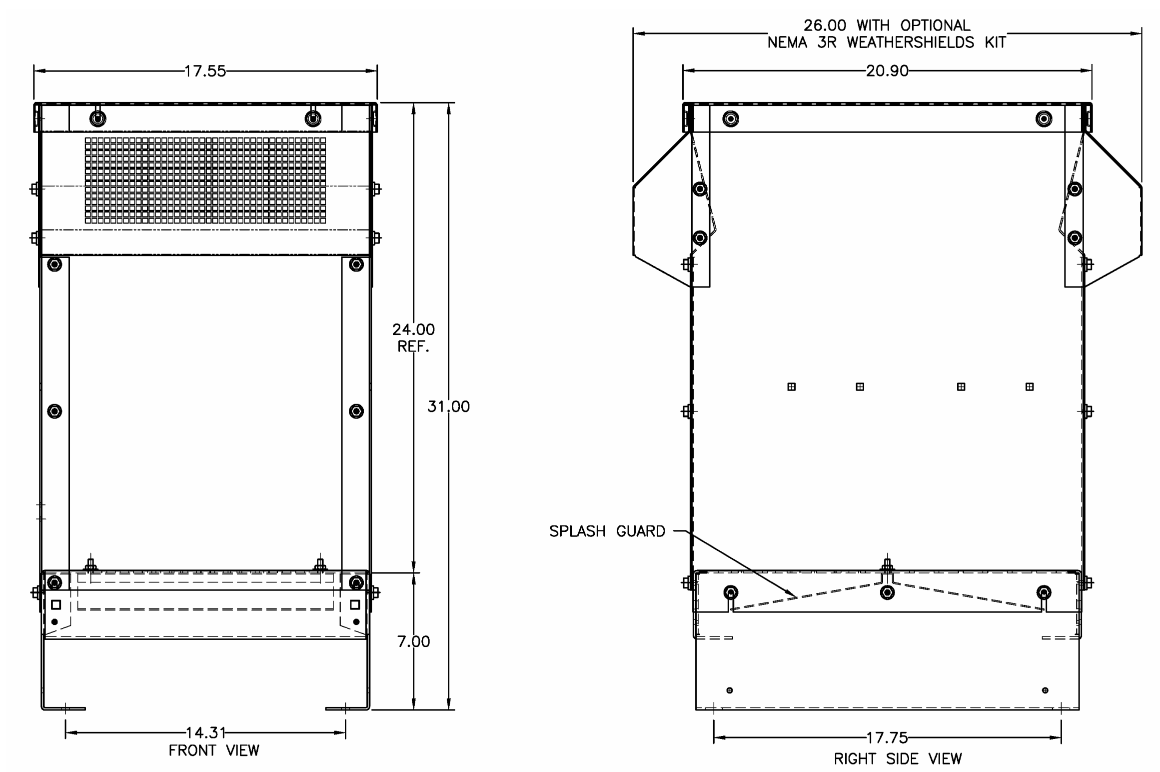


Fig. 11 Cab - 17C



Sine Wave 2-8 kHz Series A Filter
Enclosed Outline Drawings
NEMA 1-2 and 3R Enclosures
Enclosure Dimensions

Fig. 12 Cab - 26C

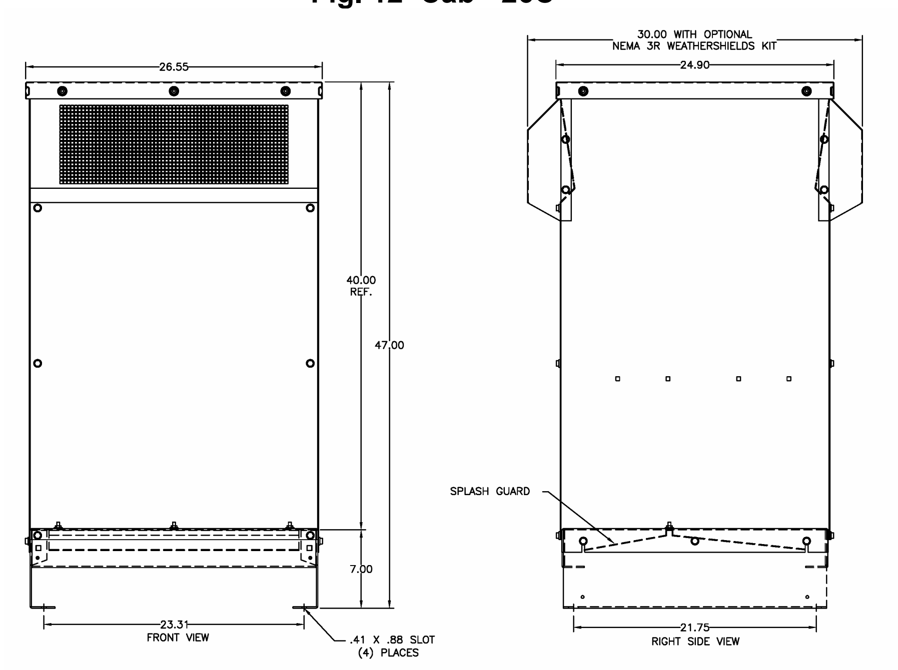
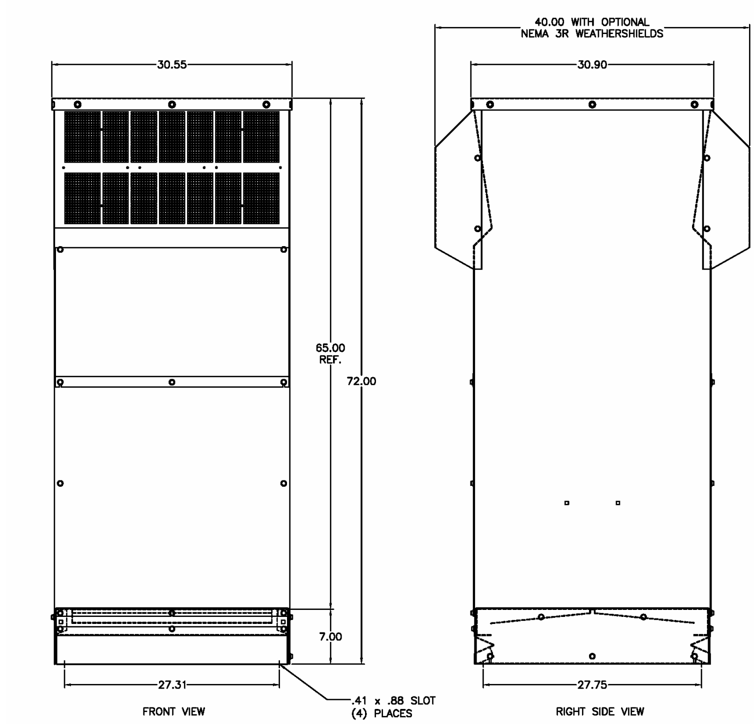
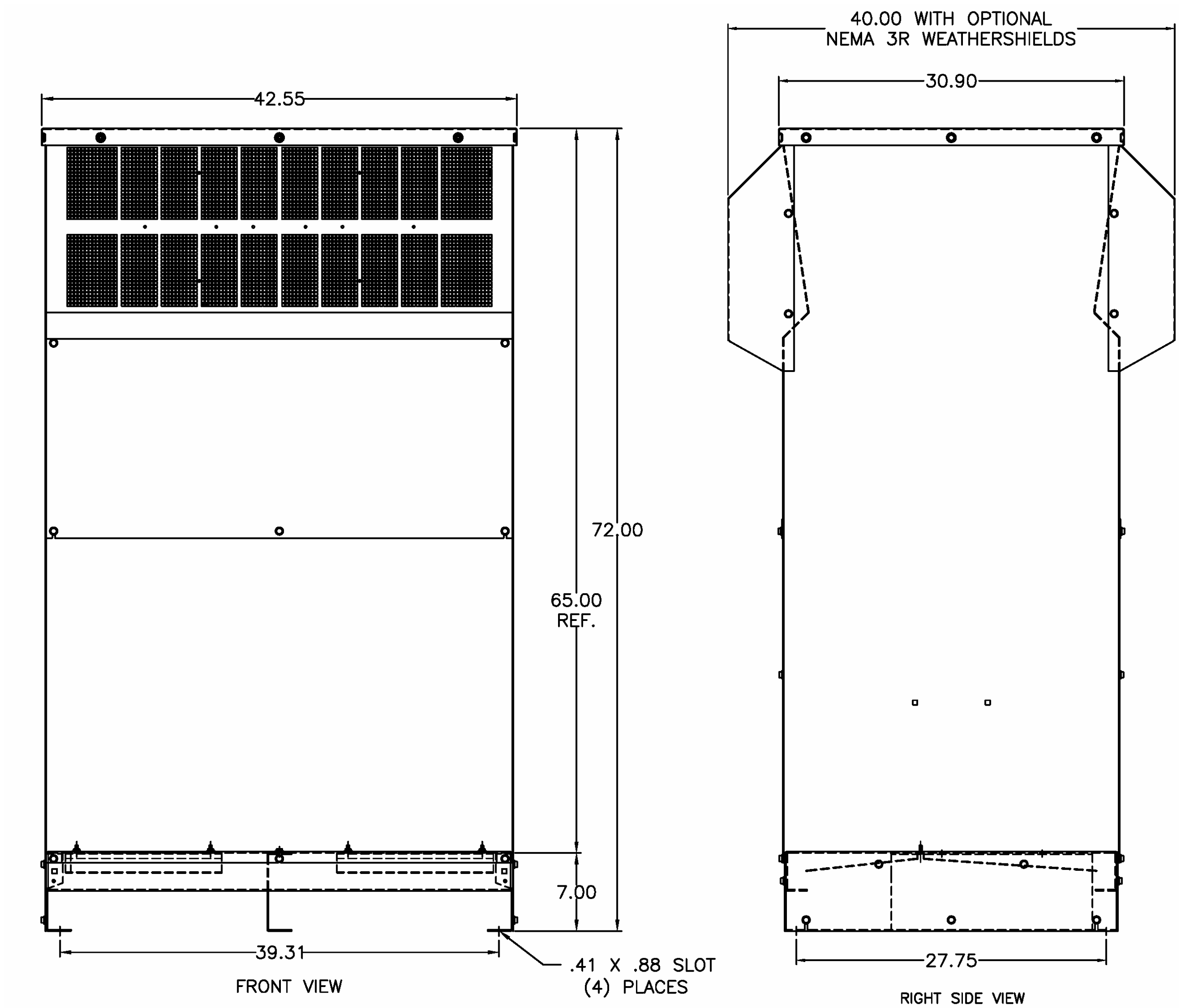


Fig. 13 Cab – 30C



Sine Wave 2-8 kHz Series A Filter
Enclosed Outline Drawings
NEMA 1-2 and 3R Enclosures Continued

Fig. 14 Cab – 42C



7 Wiring Connections

WARNING

Input and output wiring to the filter should be performed by authorized personnel in accordance with NEC and all local electrical codes and regulations.

Verify that the rating of the filter is compatible with the inverter to which it is to be connected. Follow all detailed inverter manufacturer installation and safety instructions. Inverter and load Cable selection / placement should be in accordance with the requirements of the NEC and all local electrical codes and regulations

The typical interconnection diagrams that follow are shown for a motor load but the load can be either a motor or a transformer. For enclosed filters supplied in general purpose NEMA1 and 3R cabinets and open panel filters rated less than 80 amperes, interconnection between the filter, motor and the inverter is shown in Fig. 15 Refer to the inverter user manual for instructions on interconnecting the inverter and motor and the correct start-up procedures for the inverter. The sine wave filter is primarily designed to operate from a drive using the volts per Hertz mode. For drive auto-tune or feedback using the motor consult the drive manufacture for setting the drive with output filters.

For power supply / frequency converter applications using a PWM inverter, the output of the Sine wave must feed a Delta- Wye isolation transformer to accommodate the effects of load imbalances and to cancel tripplen harmonics. See Fig. 17 for details.

The filter is designed for use with copper conductors with a minimum temperature rating of 75 degrees C. Table 7 lists the wire range and terminal torque requirements for the power input and output connections.

For panel mounted filters rated 80 amperes or more, the filter reactor is supplied loose and the RC network is supplied as an RC panel assembly. Refer to fig. 16 for a typical interconnection diagram. To select appropriate conductors for the wiring between the reactor and the RC panel refer to table 8. Table 7 contains the terminal specifications for these connections.

Use the cable recommended by the inverter manufacturer to connect the inverter to the filter and the filter to the motor. Make certain, that the selected cable size conforms to the requirements of the National Electric Code and all local codes.

For open filters refer to Fig. 3 through 5 for the location of Input, output, and ground connections. For enclosed filters, ground terminals will be clearly marked. Power wiring terminations are clearly marked on the reactor. Larger enclosed filters require power for the fans. A terminal for 115 VAC 50/60 Hz fan power is also provided for connecting to clean customer power. See table 10 for fan wiring.

Grounding

The filter must always be grounded with a grounding conductor connected to ground terminals.

For cable shield grounding follow the inverter manufactures recommendations. Fig 15 & 16 shows a typical shield ground connection.

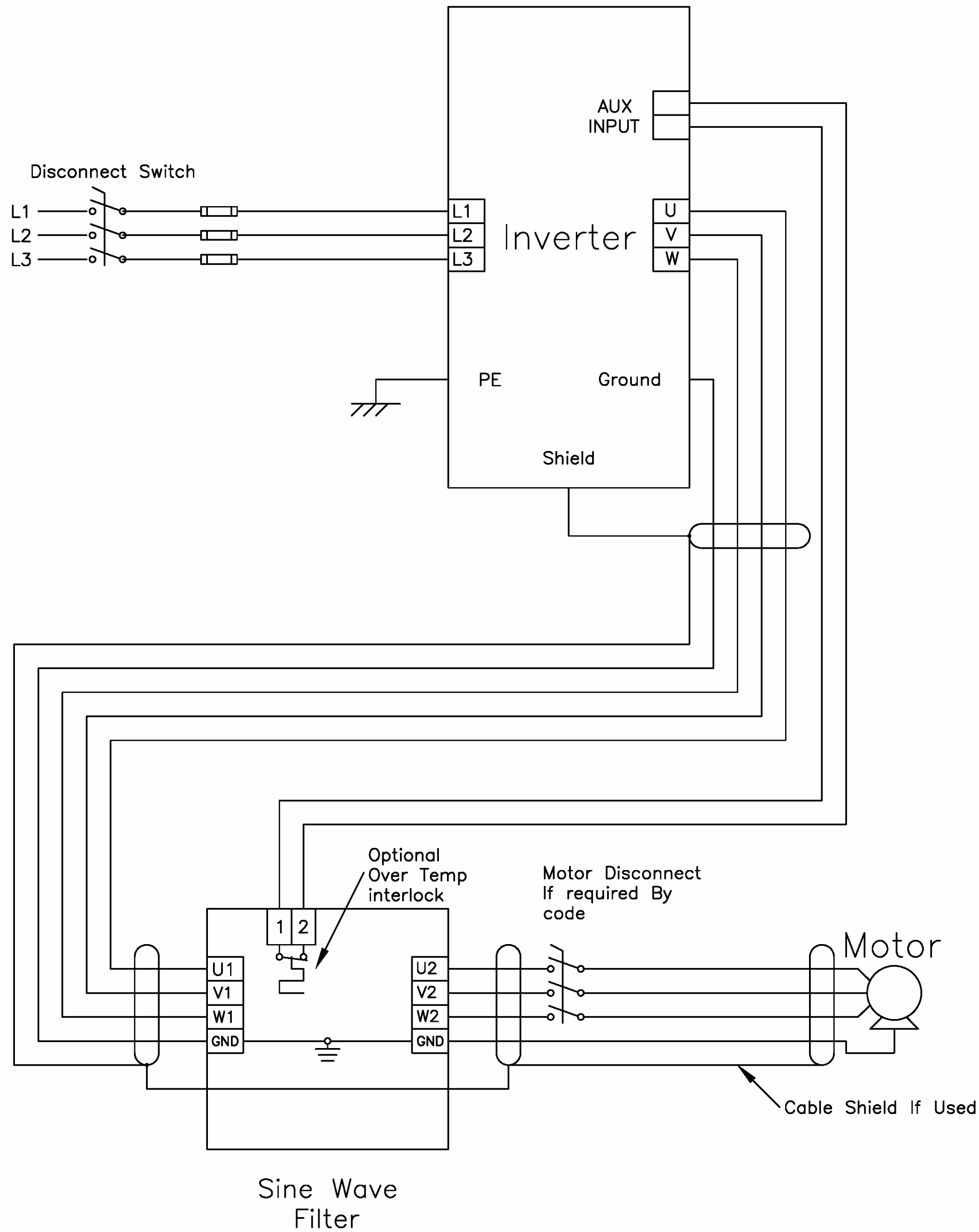
Optional Over Temperature Interlock

The optional over temperature interlock can be used to turn off the inverter in the event it is setup to operate with a switching frequency outside of the range of the filter or an inverter / motor malfunction. The temperature switch is normally closed and will open when an internal reactor temperature of 180 °C is reached. See table 9 for contact rating information and the inverter user manual for interconnection information.

Sine Wave 2-8 kHz Series A Filter

Sine Wave Interconnection diagram

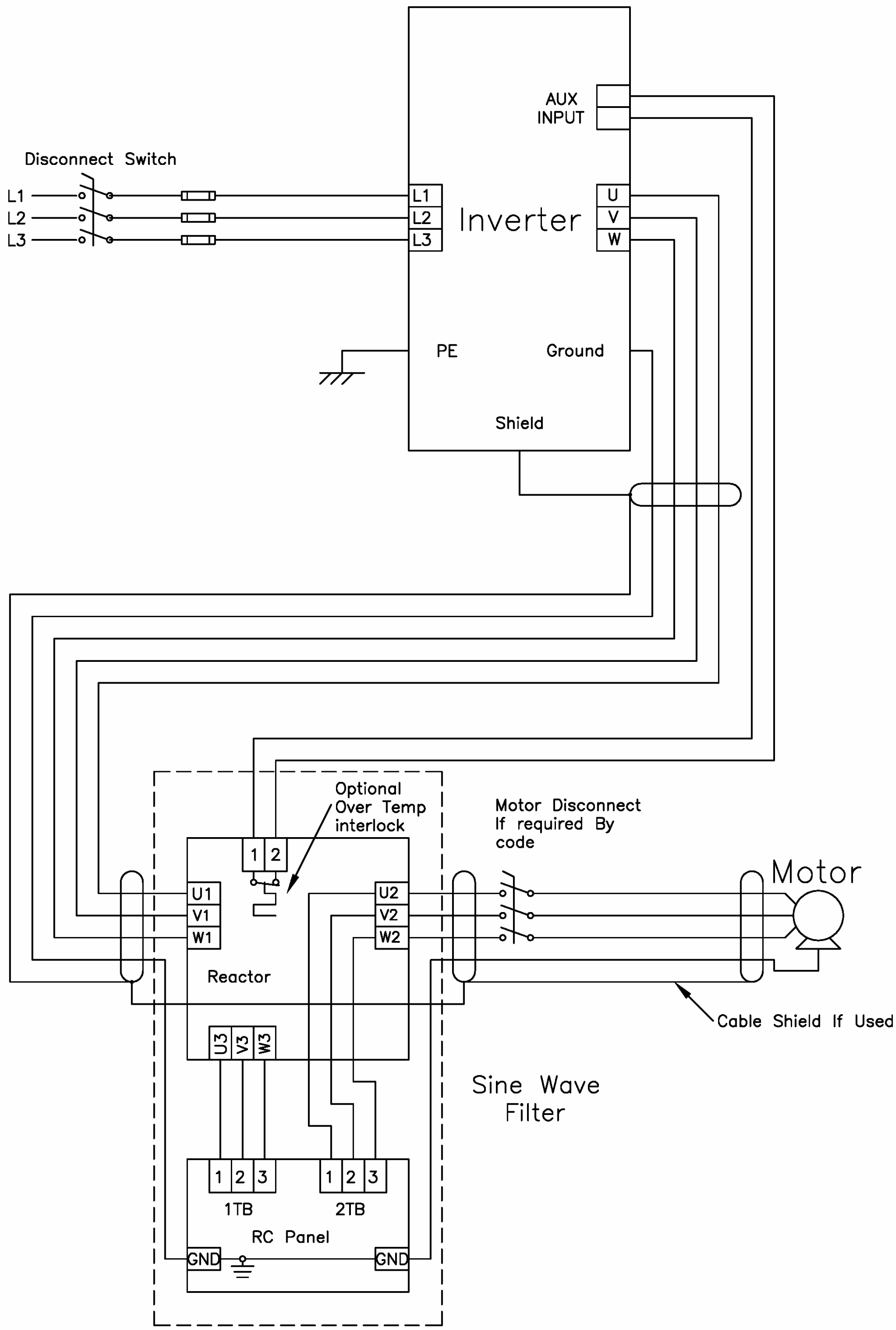
Open Style 2 – 80 Amps
Enclosed 2 – 720 Amps
Fig. 15



Sine Wave 2-8 kHz Series A Filter

Interconnection diagram Open Style 80 – 720 Amp

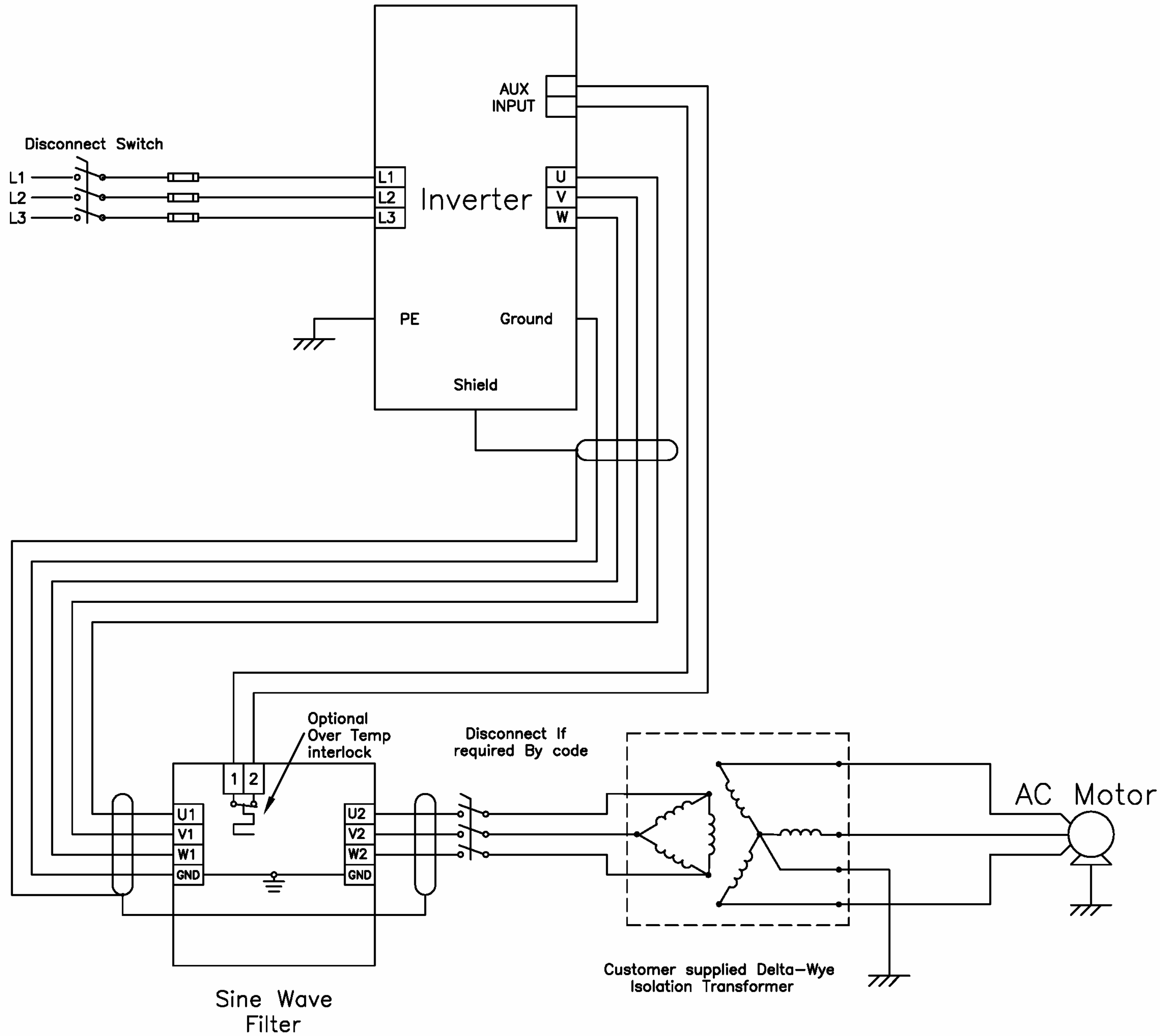
Fig. 16



Sine Wave 2-8 kHz Series A Filter

Isolation Transformer connections

Fig. 17



Sine Wave 2-8 kHz Series A Filter

Terminal Specifications

Table 7

Filter Rating	**Input / Output Terminals**		***Reactor to RC Panel Open style only**
Amps	Wire Range (AWG)	Terminal Torque (in-lbs)	75 °C conductor AWG
2	22-14	16	N/R
3	22-14	16	N/R
5	22-14	16	N/R
7	22-14	16	N/R
9	22-14	16	N/R
12	22-5	16	N/R
17	22-5	16	N/R
22	22-5	16	N/R
27	22-5	16	N/R
35	22-5	16	N/R
45	18-4	20	N/R
55	18-4	20	N/R
65	6-4 & 2-0	50	N/R
80	6-4 & 2-0	50	12
110	3/0 *75C*	250	12
130	4/0 *75C*	250	12
160	3/0 *90C*	250	8
200	**4/0 *90C* 250MCM *75C***	325	8
250	**400MCM *90C***	375	8
305	**600MCM 4/0 2X *90C***	375	8
365	**300MCM 2X *90C***	375	8
415	**350MCM 2X *90C***	375	4
515	**600MCM 2X *90C* 300MCM 3X *90C***	375	4
600	**500MCM 3X *90C***	375	1
720	**500MCM 3X *90C***	375	1

***See fig. 16 for customer wire connections.**

***Size interconnecting wire to carry current shown on table 8.**

Sine Wave 2-8 kHz Series A Filter

Maximum RC PANEL Current for Open Wiring

Inter-connect wire sizes

Table 8

Filter Rating	230 Vac Units	460 Vac Units	575 Vac units
Amps	**Maximum Amps RMS**	**Maximum Amps RMS**	**Maximum Amps RMS**
80	10	11	11
110	14	16	16
130	17	17	17
160	21	22	21
200	-	27	23
250	32	33	29
305	-	40	37
320	41	-	-
365	47	49	46
415		54	54
515		66	66
600		80	75
720		86	80

See figure 16 for interconnection details. Each of the six interconnection wires should be rated for the current from the above RC panel wiring table. See table 7 for 75 °C wire examples.

Sine Wave 2-8 kHz Series A Filter

Option 01

OVER TEMPERATURE INTERLOCK

Table 9

TYPE	BI – METAL THERMAL SWITCH
CONTACT	(NC) NORMALLY CLOSED
RATINGS	6A 120 VAC RESISTIVE 3A 240 VAC RESISTIVE 5A 120 VAC INDUCTIVE 2.5A 240 VAC INDUCTIVE
TEMPERATURE CONTACTS OPEN	180°C

Sine Wave 2-8 kHz Series A Filter

Fan Power

All enclosed part number filters listed below have fans that require a source of clean 115 volt 50/60 Hz power.

Table 10

Filter Voltage	PN NEMA1	PN NEMA3R	Cab	Fans	total load amps
200-230 VAC	SWAGC0200A	SWAWC0200A	26C2/3	2 x 6"	***0.48***
	SWAGD0250A	SWAWD0250A	30C2/3	2 x 10"	***0.96***
	SWAGD0320A	SWAWD0320A	30C2/3	2 x 10"	***0.96***
380-480 VAC	SWAGC0160D	SWAWC0160D	26C2/3	2 x 6"	***0.48***
	SWAGD0200D	SWAWD0200D	30C2/3	2 x 10"	***0.96***
	SWAGD0250D	SWAWD0250D	30C2/3	2 x 10"	***0.96***
	SWAGD0305D	SWAWD0305D	30C2/3	2 x 10"	***0.96***
	SWAGD0365D	SWAWD0365D	30C2/3	2 x 10"	***0.96***
	SWAGD0415D	SWAWD0415D	30C2/3	4 x 10"	***1.92***
	SWAGD0515D	SWAWD0515D	30C2/3	4 x 10"	***1.92***
	SWAGE0600D	SWAWE0600D	42C2/3	4 x 10"	***1.92***
	SWAGE0720D	SWAWE0720D	42C2/3	4 x 10"	***1.92***
550-600 VAC	SWAGD0130E	SWAWD0130E	30C2/3	2 x 10"	***0.96***
	SWAGD0160E	SWAWD0160E	30C2/3	2 x 10"	***0.96***
	SWAGD0200E	SWAWD0200E	30C2/3	2 x 10"	***0.96***
	SWAGD0250E	SWAWD0250E	30C2/3	2 x 10"	***0.96***
	SWAGD0305E	SWAWD0305E	30C2/3	2 x 10"	***0.96***
	SWAGD0365E	SWAWD0365E	30C2/3	2 x 10"	***0.96***
	SWAGE0415E	SWAWE0415E	42C2/3	4 x 10"	***1.92***
	SWAGE0515E	SWAWE0515E	42C2/3	4 x 10"	***1.92***
	SWAGE0600E	SWAWE0600E	42C2/3	4 x 10"	***1.92***
	SWAGE0720E	SWAWE0720E	42C2/3	4 x 10"	***1.92***

Note: The clean 115 volt control power to the fans is customer supplied.

A terminal block labeled “Fan Power” is provided inside the enclosure for this purpose

8. FILTER DESCRIPTION

The MTE Series A Sine Wave Filter is a low pass filter containing proprietary technology, which makes it particularly useful for filtering the output of PWM inverters. The filter consists of a reactor and a resistor capacitor network. Figure 18 shows a block diagram of the filter. The PWM output from the inverter is connected to the input terminals of the reactor. The load, which can be either a motor or a transformer, is connected to the output terminals of the reactor.

MTE Series A sine-wave filters are designed to provide a sine wave output voltage when driven from PWM inverters with switching frequencies from 2 kHz to 8 kHz. For drive applications, these filters eliminate the problem of motor insulation failures and they also reduce electromagnetic interference by eliminating the high dv/dt associated with inverter output wave forms. For alternate energy applications where an inverter is used to return power to the utility distribution system through a step up transformer these filters meet the requirements of IEEE 519.

Sine wave filters are available in open panel, NEMA 1, 2, and 3R mechanical configurations. For both variable torque and constant torque applications, select filters based on the horsepower rating of the motor. Filter current ratings have been designed to meet the requirements of NEC motor current ratings. For applications that use motors with current ratings that exceed NEC values selected a filter with a current rating equal to or greater than that of the load.

For inverters feeding isolation transformers select a filter with a current rating equal to or greater than that of the transformer primary current.

Typical applications for Series A sine-wave filters are submersible pumps, low voltage drives feeding medium voltage motors, HVAC equipment, wind turbines and applications where the distance between the motor and inverter is up to 15,000 feet.

Note: Series A sine-wave filters can only be used with PWM inverters with switching frequencies set between 2 and 8 kHz.

For voltages other than 440-480, 550-600 VAC, contact the factory.

Filters for motors that will be operated above 60 Hz should be selected based on the frequency de-rating curve (Chart 2) shown on page 7.

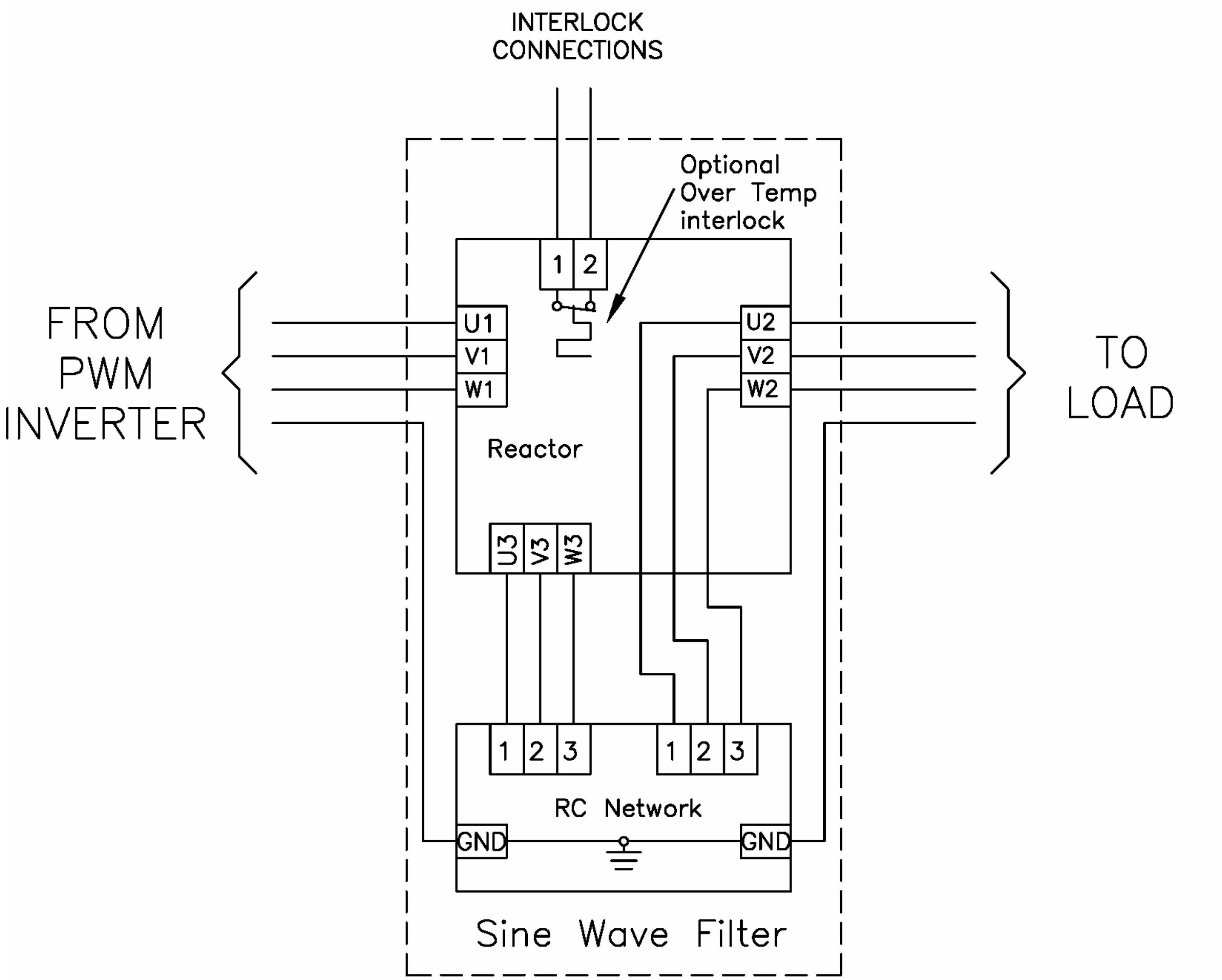
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Sine Wave 2-8 kHz Series A Filter

200 V – 600 VAC

BLOCK DIAGRAM

FIGURE 18



9. Startup

Safety Precautions

Before startup, observe the following warnings and instructions:

WARNING

Internal components of the filter are at line potential when the filter is connected to the drive This voltage is extremely dangerous and may cause death or severe injury if you come in contact with it.

WARNING

After disconnecting the utility power, wait at least 5 minutes before doing any work on the filter connections. After removing power, allow at least five minutes to elapse and verify that the capacitors have discharged to a safe level before contacting internal components. Connect a DC voltmeter across the capacitor terminals. Start with the meter on the highest scale and progressively switch to a lower scale as the indicated voltage falls below the maximum value of the scale used.

Sequence of Operation

1. Read and follow safety precautions. Including those of drive manufactures.

2. After installation, ensure that:
- All filter ground terminals are connected to ground.
- Power wiring to the utility, inverter, filter and motor is in accordance with the installation and connection instructions in Chapter 5.

3. Check that moisture has not condensed on the filter components. If moisture is present, do not proceed with startup until the moisture has been removed.

WARNING

Use extreme caution to avoid contact with line voltage when checking for power. INJURY OR DEATH MAY RESULT IF SAFETY PRECAUTIONS ARE NOT OBSERVED.

4. Refer to the inverter user manual for the inverter startup procedure. Observe all safety instructions in the inverter user manual.

5. Disconnect filter output terminals from the motor.

6. Set the inverter switching frequency between 2 kHz and 8 kHz. Refer to the inverter user manual.

CAUTION

Damage to the filter may occur if the inverter frequency is not set between 2 kHz and 8 Khz.

7. Turn the inverter ON

8. Confirm that inverter voltage is present at the input terminals (U1, V1, W1) of the filter.

9. Confirm that inverter voltage is present at the output terminals (U2, V2, W2) of the filter.

10. Disconnect the inverter from the AC Line and wait 5 minutes.

11. Connect the filter output to the motor.

12. Refer to the inverter user manual for the motor startup procedure.

10. Trouble Shooting

WARNING

INJURY OR DEATH MAY RESULT IF THE INVERTER SAFETY PRECAUTIONS ARE NOT OBSERVED.

CAUTION

WARNING

When properly installed, this equipment has been designed to provide maximum safety for operating personnel. However, hazardous voltages and elevated temperatures exist within the confines of the enclosure. Servicing should therefore be performed by qualified personnel only and in accordance with OSHA Regulations.

To aid in troubleshooting a block diagram is shown in figure 17 and interconnection diagrams are shown in figures 15 and 16 A list of potential problems and solutions are listed below.

WARNING

High voltage is used in the operation of this filter. Use Extreme caution to avoid contact with high voltage when operating, installing or repairing this filter. INJURY OR DEATH MAY RESULT IF SAFETY PRECAUTIONS ARE NOT OBSERVED.

After removing power, allow at least five minutes to elapse and verify that the capacitors have discharged to a safe level before contacting internal components. Connect a DC voltmeter across the capacitor terminals or terminals U1, V1or V1, W1 Start with the meter on the highest scale and progressively switch to a lower scale as the indicated voltage falls below the maximum value of the scale used.

Sine Wave 2-8 kHz Series A Filter

PROBLEM:	**Voltage is not present at the filter Input terminals.**
Possible cause: **Solution:**	Power to the inverter is turned off or shut down. Turn power on, check inverter errors.
Possible cause: **Solution:**	One or more external line fuses are blown. Verify the continuity of line fuses in all phases. Replace as necessary.
Possible cause: **Solution:**	Inverter is defective or undersized Refer to inverter user manual. Larger filter
Possible cause: **Solution:**	Inverter fault, Large filter causes over current fault by filter cap load. Select filter to match motor FLA, increase size of drive to allow for long lead cable application.

PROBLEM:	**Sine Wave filter runs Hot**
Possible cause: **Solution:**	Normal operation reactor and resistors are > 120 °C Caution parts are very hot and may cause burns. Follow installation guidelines for clearances and check for adequate air flow.
Possible cause: **Solution:**	Inverter switching frequency is not set between 2 kHz and 8 kHz Set switching frequency above 2 kHz
Possible cause: **Solution:**	Heat buildup within enclosure Provide clearance and venting for filter components

ISO 7.2.3	Sine Wave Filter Series A 200-600 VAC User Manual		INSTR-020
Revision	**Date**	**Revision History**	
---	10/12/05	New document written by Wayne Walcott	
080310	03/09/08	By WRW Updated per ECN 5695: updated open panel Reactor size table 4; added fan power table 10 for cabinets	